The Builder.

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Two Chapters in Colonial Architecture.

THE architectural efforts of a new colony have always a certain special interest. If the colonists are persons well off, well educated, and able to bring with them the materials and artificers necessary to produce something like a repetition of the architectural fashions of their native land, it becomes a curious problem how far they will actually imitate these, how far their way of designing and constructing will be modified by new conditions and new materials. This is the kind of interest presented by what is generally spoken of as the "Old Colonial" domestic architecture of certain districts of the United States. A great deal of this, especially in interior details, is the architecture of the school of the Adams, a little more naïve and simple than its original; and in external work sometimes showing the Classic order carried out in wood instead of in stone, simplified in its details and perhaps attenuated in its proportions. But there is another form of Colonial architecture, equally interesting in its way, which represents the first efforts to build for necessity only, with the materials and means at hand, and without reference to any preconceived theory of architectural style. Some years ago we published an interesting communication on this phase of building from a correspondent in Australia, accompanied by photographs showing the development from the plainest and most unpretending form of hut, called a "humpy," and made with whatever rough materials came next, to the decent-looking planked "town-hall" of a settlement which had just begun to crystallise into a "town," viz., a row of dwellings in some sort of order on each side of a laid-out street. The Australian "humpy" is perhaps the most entirely uncouth and uninteresting kind of dwelling ever put up by the hands of civilised men; as its name seems almost intended to imply, it consisted of materials heaped up rather than built, and presented nothing even of constructional interest or character. Some of the early colonists in the United States appear, however, to have started a manner of constructing houses with the skill and materials available at the moment, which, though simple enough, has a good deal of character. This is the class of early domestic buildings of the first settlers in Connecticut in the middle of the seventeenth century, of which some examples remain, and which has been made the subject of an illustrated volume by two American architects,* Mr. Isham and Mr. Brown.

The peculiarity of these early Connecticut houses is their general adherence to a normal type of plan and construction peculiar to themselves, and the manner in which this was developed by the circumstances under which they were built. Timber was plentiful, and was the most obvious material for house-building, but fireplaces were requisite, and could not be constructed in wood. Hence the method came to be to build a good solid stone chimney-stack in the centre of the site, with two back-to-back fireplaces and the stack rising above them, and then to build symmetrically round or on each side of this nucleus with a timber framing. It is rather curious that one feature of the house almost always was an upper story oversailing on one side. We have been accustomed to think that the fashion for overhanging upper stories arose in Mediæval cities from the crowded state of the town confined within the definite limits of its walls, and the necessity for keeping a sufficient width of street-way below while providing sufficient living room in the upper stories; but here was a case in which, one might suppose, ground area was practically unlimited, and nevertheless the ground story was contracted and the upper story projected out. One can only conclude that, while two rooms sufficed the early settlers for their living, they wanted more space above for division into a larger number of bedrooms, and they did not care to make the ground story any larger than was really necessary for their accommodation.

The typical Connecticut house of the period consists, therefore, of two rooms with a bulky stone (or sometimes, at rather later date, brick) chimney between them; the first floor being carried by a beam called a "summer"; evidently one-half of the word "brest-summer," the first half having been lost in crossing the Atlantic. The "summer" almost always ran parallel with the length of the house, from the chimney to the gable, each way. The entrance was opposite the chimney block, between the two main rooms into which the ground plan was divided. The outer walls were of framed timber filled in between the uprights with clay mixed with hay, boards called "clapboards" being nailed outside over the whole. "Clap-board" has had various meanings at different times and places, but here it probably means boards nailed so as to overlap, as in a clinker-built boat. The roofs were very steep; sometimes shingled and sometimes thatched. An occasional variation in the plan occurs in cases where there were two stone chimney stacks, one at each end of the house, and the rooms enclosed between them. But the plan with the central stack seems to have been the favourite or typical one.

One of the oldest of these houses examined by the authors of the book was the Whitman house at Farmington, of which we give copies of the first story plan and the exterior view (figs. 1 and 2). This is the early form of two-roomed house with the chimney stack in the centre, and the entrance opposite to it; the lines of the two "summers" are seen dotted on each side of the chimney-stack. This house, also, had an addition with a lean-to roof, which was the first manner of supplying further accommodation than the original two rooms afforded.

* "Early Connecticut Houses." An historical and architectural study. By Norman M. Isham, A.M., architect, and Albert F. Brown, architect. Providence, R.I.: The Preston and Rounds Company. 1900.

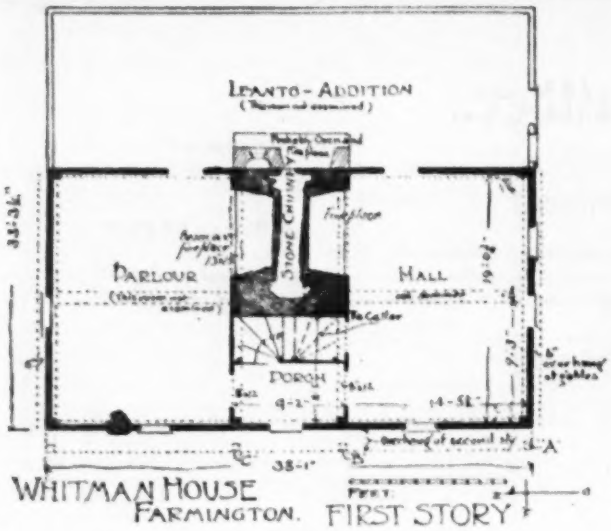


Fig. 1.

Fig. 2.

Fig. 3.

Fig. 5.

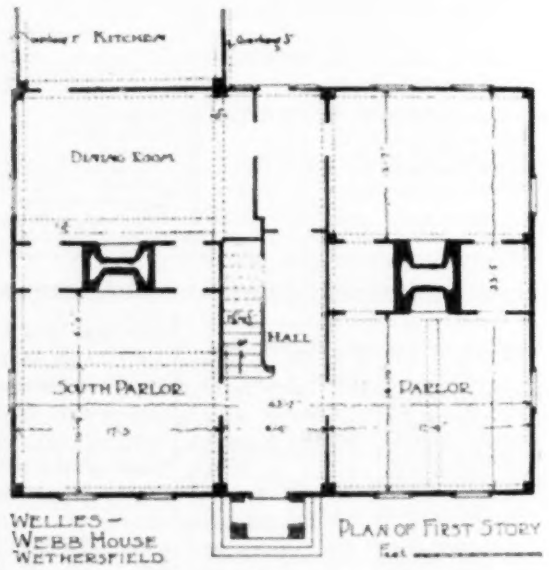


Fig. 4.

The view shows, also, the common though apparently not universal feature of the overhang of the upper story; in this case, as in some others illustrated in the book, decorated with a simple shaped pendant, which, however, appears, from the detailed illustration (fig. 3), to have been affixed as a separate piece, and not shaped out of a continuation of the upright, as would have been the more workmanlike and more architectural method. It is, however, a good bit of simple ornament.

The authors classify these old Connecticut houses under three periods, of which the Whitman house illustrates the first. We cannot follow out the details of the changes which characterise what are distinguished as the second and third periods; we must refer the reader to the book; nor can we discern sufficient difference between the houses of the first and second period, as described, to quite justify making a separate classification of them. It is noted, however, that at this period the chimney-stacks were frequently built of brick instead of stone. In the "third period" there are distinct and important changes. The old lean-to is abandoned, and the additional rooms at the back are made the same height as the rest of the house. The increased use of plaster led to the abandonment of the "summer" as a visible feature in the rooms; where used, it is kept flush with the general level of the ceiling and plastered over with the rest. The form of plan with two chimney-stacks, one at each end of the house, becomes more common, and examples of it are given. But the most interesting and characteristic development of the plan is that shown in the Webb house, at Wethersfield—a place possessing several of these old houses. This, as shown in fig. 4, is the old two-roomed house duplicated, the two blocks being turned half-round and placed transversely to the front instead of longitudinally, and the entrance, hall, and staircase arranged in a space left between them. Fig. 5 gives the exterior appearance of this house, which forms a very interesting example of the development of plan from a very simple origin. The Ebenezer Grant house, described and illustrated in a subsequent chapter, shows a further elaboration of plan in the back part of the house, the duplicated plan, like that of the Webb house, being retained in the front block; the whole plan now taking a L shape. In this plan also the chimneys are not in a line, one being nearer to the front than the other; which, as far as the general appearance of the house is concerned, is not an improvement. The front entrance door, of which the authors give a separate elevation, is a heavy and exceedingly clumsy imitation of the English Late Classic doorway, with short pilasters and an immense lumpy moulded cornice, intended to represent the Classic entablature, but in which the elements of architrave, frieze, and cornice are jumbled up into one agglomerate of clumsily designed mouldings; the whole crowned by a very steep broken pediment, a caricature of the feature familiar in English work. This doorway, however, is an indication that borrowed conventional ideas of architectural style had now begun to intrude, and that the simplicity and naïveté of the older Connecticut houses was at an end.

The book contains a great deal of very interesting information in regard to details of house furniture, finish and construction at the period represented by these old houses. In particular, an inventory of the contents of one of the later and larger houses, Governor Eaton's house at New Haven, which has now disappeared, throws a great deal of light on the home life of the period. The inventory is dated 1657. The house, of which an old view exists which the authors have reproduced, was on the E plan, and more like an English house than most of the others illustrated in the book. The authors have made an attempt to restore the plan and the arrangement of the furniture on the basis of the suggestions of the inventory.

Among other details given in regard to constructional work, it is suggested that the clap-board covering was first employed merely as a means of covering the leaks between the studs and the filling. The clap-boards were of oak until a late period. The preliminary work was done in the woods; a tree was felled and divided into the lengths usually required—either 4 ft., 5 ft., or 6 ft.; these lengths riven into "bolts" (the authors suggest that these were probably quarters of the log), and the "bolts" brought into the town to be further cut up by carpenters. "The clap-boards for the meeting-house at Windsor, or rather the bolts for them were

'to be brought home by the latter end of the week following . . . and Samuel Grand is to cleave them when brought home; and so fit them and nail them about the meeting-house.' This work was called 'clabbing.'" The windows were very small in the early houses, and probably had often to go without glass and be fastened up when necessary by shutters. The walls were generally lined internally with wood—"wainscot," and the partitions between rooms were made of inch pine boards grooved and tongued. Paint was apparently not used till a late period in the Connecticut houses, "for there are many fine specimens of pine panelling with no finish on them. They do not need any. The wood is still sound, with perfectly sharp edges, and the colouring, partly from age and sun, partly from wood smoke, has become something very beautiful, unapproachable by any painted or varnished surface."

We have only indicated the main points of interest in this book, which is full of information on what may be called an almost unknown chapter in the history of domestic architecture. The authors say that they have personally examined every building now standing of which they give a drawing; and the book appears to be thoroughly well done and reliable in its illustrations and information.

Almost simultaneously with this work on a form of Colonial architecture in America we have received another on the characteristics of Dutch Colonial architecture at the Cape of Good Hope*, by an amateur, but accompanied by a chapter on the origin of this type of architecture by an English architect practising at the Cape, Mr. Herbert Baker. This (whatever it may be considered at the present moment) is not English Colonial architecture in respect of the old houses here described, as it all belongs to the period of Dutch occupation; but architecturally the special interest in it is just the same—it represents the form taken by architecture in a new colony, and its relation to the architecture of the mother country. Mr. Baker notes that there is little resemblance between the old homesteads of the Dutch colonists and the houses of their ancestors in the mother country. The difference however consists in the plan more especially:—

"Neither in the small low, tile-roofed sheds of the Holland marshes, nor in the many-storied, narrow-fronted houses of the cities, is there any exact prototype of the spacious colonial homestead. We find in the latter a large hall, and a broad 'stoep,' or raised platform, surrounding the house and adapted for primitive life and open hospitality. The bedrooms and kitchens lead directly off the hall, and are placed so as to be spanned by a single thatched roof."

Two plans are given as typical of the Cape House, one in the form I, with the entrance at the bottom of the upright shank; the other a square with two projecting wings on one face, leaving a gap or court between them. That people who had been in the habit of building in streets should alter their plan when they had to build in cleared country, and when they were transferred from a town life to a farm life, is what might be expected. In both the types of Cape House plan as given by Mr. Baker the central portion is a large hall with a screen across the middle. In the I plan the shank forms the hall, and the rooms in the wings right and left open one out of another; in the more convenient square plan the rooms open separately from each side of the hall. The first-named form, he tells us, is most common in the Cape Peninsula, the second beyond the peninsula. We should imagine that the second or square form was later in date, and was adopted after an experience of the inconvenience of the access to one room through another, in the I form of plan.

Having begun by mentioning how little resemblance there is between the Dutch houses at Cape Colony and in Holland, Mr. Baker, rather unexpectedly, employs the remainder of his chapter in remarking on the architectural resemblance between the gable treatments on the Colonial houses and those of Amsterdam and other Dutch or Belgian cities. The comparative examples given are interesting; but the noticeable point, to our thinking, is that the Dutch Colonial builders applied to their extended square country-houses the types of curved gable which were, in their original loca-

* "Old Colonial Houses at the Cape of Good Hope." Illustrated and described by Alys Fane Trotter. With a Chapter on the Origin of Old Cape Architecture; by Herbert Baker, A.R.I.B.A. London: B. T. Batsford. 1900.

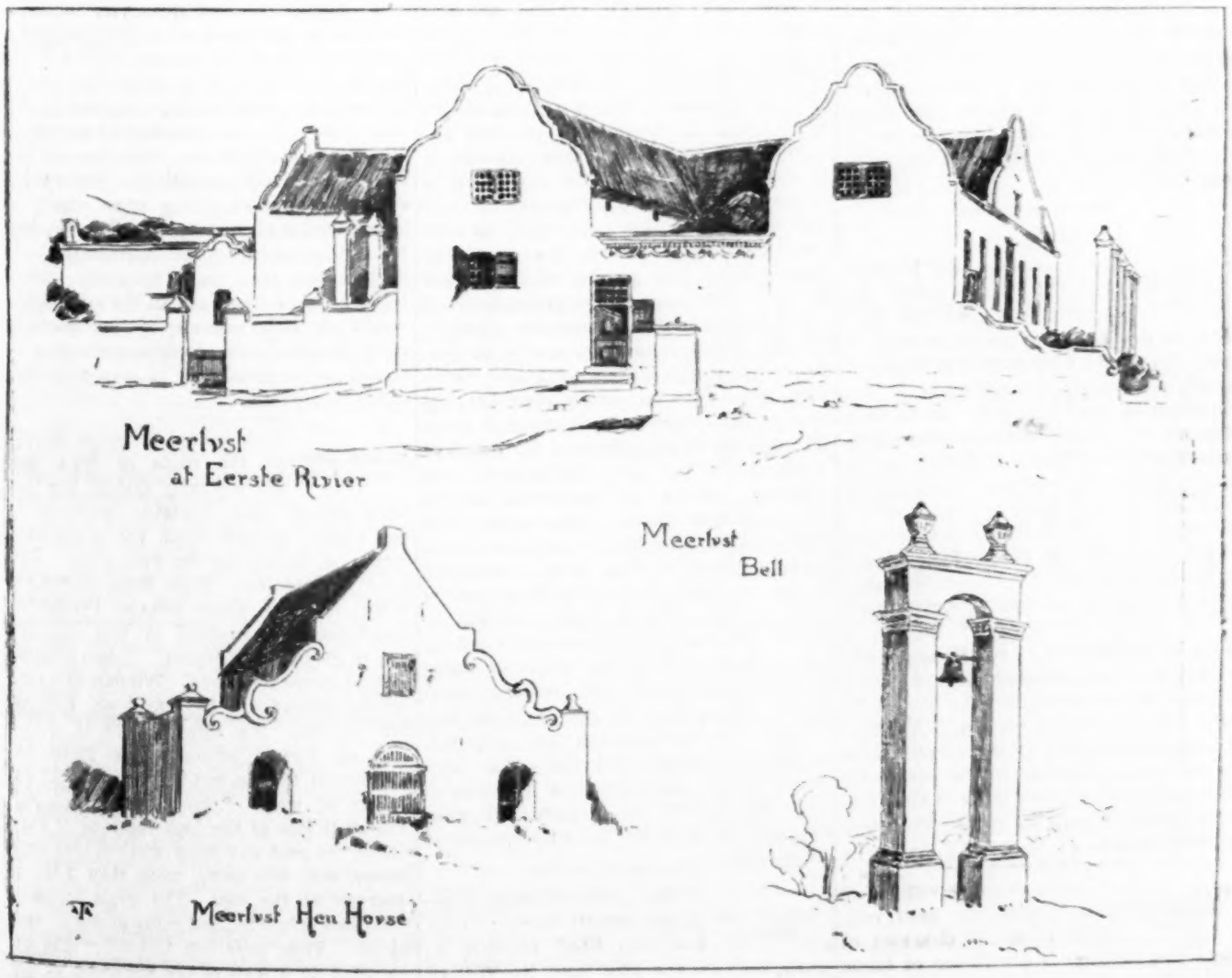


Fig. 6.

lity, the terminations to narrow street fronts, and it is the transference of these form to a new use which gives a good deal of its peculiar character to the Dutch Colonial house. It shows the curly-lined gable applied at intervals along the extended walls of the Colonial house, instead of forming the sky-line termination of a single strip of street front. This explains the peculiar character of the architectural treatment of Mr. Rhodes's house, which was illustrated in the *Builder* of March 24; for though a new house, this is a professed reproduction of the style of the Dutch Colonial house. The same characteristic is seen in some of the old houses illustrated in the book before us.

There is, however, a great variety of picturesque treatment in the houses sketched in this collection, which ought to be particularly interesting just now, on account of the closer and we hope in time peaceful connexion which there is likely to be between Great Britain and South Africa. We can hardly doubt that the region of the Cape will furnish employment to some of the young English architects who find the field at home too crowded; and those who have any hopes or wishes in that direction will find this book useful in giving them an idea, in advance, of the local character of the older Colonial architecture, which may at all events afford them a suggestive basis to work on. And in any case the book should be of interest to architects as illustrating a very picturesque phase of domestic architecture. Mrs. Trotter's sketches, for the work of an amateur, are admirable, and call for no criticism. Some of the illustrations are from photographs, but the majority are original drawings, of which the best are those in lithographic chalk. From among the line drawings we give a reduced reproduction of the accompanying characteristic bits from Meerlust farmhouse (fig. 6), in which, as will be seen, the Amsterdam scroll type of gable has been applied to the decoration of a hen-house.

NOTES.

Architecture as a University Study.

THE President of the Institute of Architects has taken the opportunity of some correspondence in the *Times* on the University of London to make a fresh protest in favour of including the study of architecture in the curriculum of the University. As he truly observes, "When one sees what has recently been done by the Victoria University in this country and by nearly all the Universities in the United States in deciding that a systematic course of study in architecture, equally with law, medicine, and engineering, should be recognised as one of the roads towards a University degree, the lack of this recognition in the new University of London is much to be deplored." Mr. Emerson was quite right to take the opportunity of making a protest, though we sadly fear it is made in vain. There is among average Englishmen a curious combination of stolid indifference to architecture together with a persuasion that they know all about it by the light of nature, which forms a *vis inertiæ* very hard to strive against.

The Frescoes at Westminster Palace.

IT appears that Professor Church, who has been consulted as to the cleansing of the fresco paintings in the House of Lords and in the Lords' Corridor, has decided that it is not advisable to undertake any operations on them at present, as the summer is the most favourable time, and the work will be deferred, we presume, till next summer. Now that the paintings are there it is right, of course, to keep them in a state of preservation; but one almost regrets that they were executed, at a period when there was so little perception in this country in regard to the style of design and treatment suitable for decorative art and for such a method as fresco. They serve as an unfortunate monument of mistakes both in the æsthetic and the chemistry of fresco-painting; and were they obliterated, we have artists who could unquestionably produce something much better and much more suitable to their position than most, at all events, of the existing pictures. We do not actually recommend obliterating them, but we should not be very much grieved if it were done on the responsibity of some one else. We do not refer of course, to Sir E. Poynter's paintings in the octagon; that is a different matter altogether.

A Housing Reform Conference.

WHAT is called a "North of England Housing Reform Conference" is to be opened to-day (Saturday) at Newcastle-on-Tyne, with the object of discussing the subject and passing certain resolutions. The following Local Authorities will be represented (probably with the addition of others since this list reached us):—Sunderland Town Council; Darlington Town Council; Urban Councils at Alnwick, Morpeth, Weetslade, Seghill, Hexham, Blaydon, Consett, Willington, Brandon, Jarrow, &c.; Rural Councils at Hexham and Belford. The practical working of Part III. of the Housing Act of 1890 by Local Authorities will be described by Councillor Thompson, of Richmond, whose able contribution will be remembered by those who attended the recent Conference on the same subject in London. The tenour of the resolutions to be proposed, which are too lengthy for us to give *verbatim* in this note, is (1) to urge Local Authorities to use the borrowing powers which they possess under the Act of 1890 for the purpose of acquiring land and erecting comfortable tenements thereon; (2) that Local Authorities should be empowered to compulsorily acquire land to be used under Part III. of the 1890 Act; (3) that it is desirable to promote a more thorough use of the powers of the Board of Trade to secure the provision of an adequate supply of workmen's trains; that municipal electric trams and light railways should be further developed, and a uniform system of cheap fares be enforced by law over areas surrounding large centres of population. We shall see what will be said on this head at the Conference; but we may observe that in the minds of many philanthropical people there seems to be no logical halting-place on this side of free carriage for working-men, and they will presently, perhaps, find that they have promised not only more than the community will consent to perform, but more than will be good for the working classes themselves.

Iron and Steel Institute.

AT the opening meeting of the annual autumn session of the Iron and Steel Institute in Paris, held on the 18th inst., Sir William Roberts-Austen, the President, read an interesting address on the history of the metallurgy of steel. He pointed out that a century's work had, to a great extent, revealed the way in which small quantities of added matter act, and that it has been shown that they exert profound influences even in solid metals; the fact that certain varieties of steel are "solid solutions" is now accepted, and the recognition of molecular movements in solids has become familiar. The utilisation of the waste gases of blast furnaces was dealt with in its historic aspects, commencing with the researches of Aubertot in the year 1811; the work of Sir Henry Bessemer and of Thomas and Gilchrist was passed in review, together with the principle of regeneration as applied to furnace work. Alluding to the successive production of different kinds of steel, he remarked that new properties were developed in it by the addition of certain elements such as silicon, and more especially by the rarer metals, such as manganese, chromium, tungsten, and nickel. The result was that some varieties of steel were characterised by extreme hardness, whilst others were very soft; some were magnetic, in others the magnetic permeability was low; some kinds would harden by rapid, and others by slow cooling; certain of them would even contract when heated, and expand when cooled. Speaking of the future, the President remarked that he hoped to hear much more in regard to researches on boron steel. There was one part of his address which we think might have been amplified to advantage, and that is in reference to the micro-structure of steel. The work of François, Sorby, and Osmond was alluded to, but it is very doubtful whether metallurgists as a body recognise the great value of the microscope in their researches. They seem to regard that instrument still as a kind of plaything, and hardly ever give it its true position as an aid in investigating. Only the other day at the British Association meeting a well-known experimenter, after stating some results he had arrived at chemically, said that they had been "confirmed by the microscope." If Sorby's work were more generally understood analysis by means of the microscope would certainly precede, if not succeed, many chemical and physical researches in regard to the metallurgy of steel and other similar compounds.

Riga and District Timber Trade.

THE annual Consular Report on the trade of Riga and the adjoining district has just been issued, and contains statistics of the timber exports from the south-west corner of Russia for the year 1899. The total exports from Riga were 46,700,000 cubic feet, or about 283,000 Petersburg standards, but one-third of this quantity was in the form of sleepers. Libau shipped about 100,000 standards. Windau exported 107,000 baulks and 848,000 deals, battens, and boards. No measurement is given, and no figures whatever are given for the port of Pernau, but we are told that the export of wood "showed a falling-off." The small size of the logs received at Riga during the year was more marked than ever before, very few being more than 9 in. in diameter at the top. The great majority measured only 8 in., and many only 7 in. and 6½ in. This, says the Consul, "may be regarded as a sign of the depletion of the forests from which Riga derives its supplies."

How different this is from the Riga of fifteen years ago, when mill-owners would have nothing to do with even 9-in. logs, but specified that at least 80 per cent. of every parcel must be 11 in. or more in diameter. To-day "there is a keen competition in 9-in. logs, and a lot of 10-in. is looked upon as a rarity."

Health of Shirebrook.

SHIREBROOK is a village in the Blackwell Rural District, which has come under the notice of the Local Government Board for continued prevalence of enteric fever. Dr. Monckton Copeman, in his Report to the Board, appears to attribute this partly to defects in the milk supply, or the manner in which the milk was stored till used. But he mentions, also, the recent prevalence of many large middens for the reception of excreta, which have only recently been replaced by a pail-closet system; a system which, in its turn, is likely to give rise before long to fresh difficulties, in the way of finding places to deposit the results of the pail system. Accordingly, in the summary of the Report he recommends that the water-carriage system should be adopted in the case of all new house property, and the present pail system should be abandoned; and that the Rural District Council should make such arrangements with the Colliery Company as will permit of the sewage from the upper portion of the colliery village being diverted from its present outfall, the position of which is such as to cause liability to future contamination of the water supply.

Newcastle Town Hall Scheme.

THERE seems to be a movement on foot for a new Town Hall and other important municipal improvements at Newcastle-on-Tyne, and it is becoming a matter of interest with the inhabitants to consider how they will be carried out. A Newcastle architect, Mr. Hayler, has proposed a scheme, a rough plan of which has appeared in the *Newcastle Daily Leader*, for opening up the irregularly shaped site on which stands the old Town Hall, clearing a considerable part of the area on each side of it, leaving the centre entirely open with a garden and fountains &c. where the present Town Hall stands, and placing the new Town Hall on one of the cleared sites and the new Municipal Buildings on the other, the two main façades to face each other on each side of the central garden. It looks a good idea for a fine and striking effect towards the central space—whether it is the best that can be done we do not know, because we do not know what other sites in Newcastle are available or possible; but we may point out that, although the effect of the two fronts of the buildings may be very good in this position, the effect of each building, as a whole, would be materially injured by being so close up to the older buildings on the remaining three sides, and having such narrow streets round them; and that this would not only injure their architectural effect but their lighting. This consideration seems to have been overlooked by the architect who has proposed the scheme, and the journal which appears to support it.

Communication in Railway Carriages.

A LETTER in the *Times* of Thursday, relating to some experiences in a Scotch express, contains yet another instance of the total failure of the absurd communication-cord placed "on the right-hand side in the direction in which the train is travelling," and which was pulled by the writer of the letter till it snapped (being apparently rotten), but without attracting any attention from driver or guard. It almost looks as if railway companies wilfully put this deceptive "cord" notice up in order to look well, without any intention that it should really act. This is becoming a very serious matter, and we think that the Board of Trade ought definitely to insist on railway companies having a proper and convenient means of communication between passengers and guard or driver, and keeping it in working order; and that the apparatus should be tested from time to time by a Government inspector taking a journey for the purpose, and the company heavily fined if it did not act or was not attended to.

"Natural Ventilation."

WE quote the following sensible and forcible remarks from a paper entitled "Health in the Workshop," read in the early part of this year before the Manchester Association of Engineers by Mr. J. D. Sutcliffe, and now issued in pamphlet form:—"Let us examine the claims made on behalf of the so-called 'natural ventilation,' where the air is extracted without the use of power other than the wind or differences in the temperature. It is often supposed that by fixing a particular cowl, 'siphon,' 'air pump,' or other stupidly-named patented article on the top of a building, currents of air will be produced by the cowl itself, and therefore if enough are provided the ventilation is sure to be all right. A greater mistake could not be made, and you frequently find that out of say six cowls fixed on a building, half of them will be admitting air and the other half allowing it to escape . . . . The inventor proudly tells you, as he calls your attention to the model, that if you blow across the ventilator it plainly 'exhausts,' as it lifts a piece of cotton-wool from the bottom to the top. You have only to remove his ventilator and blow across the glass tube, when the cotton-wool comes up just the same."

Improvements in Hansom Cabs.

WE have received a description and illustration of two proposed improvements in connexion with Hansom cabs, patented by Captain Dickson. One of these consists in the addition of a small wheel at the foot of what is called the "gravel iron" under the front part of the cab, and which takes the ground in the event of the horse falling. This wheel practically lengthens the iron strut by the extent of its own diameter, and is provided with a stop stud, which allows of half a revolution, so as to ease the shock or jerk when the horse stumbles. After being locked by the stud, the portion of the wheel that touches the ground, and which is grooved, acts as a drag or skid. Provision is also made for the wheel to be raised or lowered at pleasure. This seems a useful addition, and likely to act also in checking the fall of the horse, as the cab gets a better support and in a higher position. The other improvement is a strap to be hooked across the front of the cab to prevent the occupant being pitched forward against the splashboard or into the road in the case of a horse falling. We do not think it is likely to be used except by very nervous people; any one who has his wits about him can save himself from being thrown forward when the horse falls. There are two more important improvements wanted in Hansom cabs, easily made but which no one seems to think about. One is a dirt-shield to the front of the wheels, to prevent people's clothes being soiled in getting in and out; the other is a means by which the occupant of the cab can raise or lower the glass for himself, without having to appeal to the driver. This could be so easily done, and the necessity for it is so obvious, that it is quite absurd that we should continue to have Hansom cabs built with the present clumsy and dangerous arrangement for working the glass.

A HOLIDAY IN SOUTH DERBYSHIRE

BY J. TARNEY.

THE county of Derby is particularly rich in the picturesque beauty of its natural scenery, of which Ruskin writes so lovingly:—

"In its very minuteness it is the most educational of all the districts of beautiful landscape known to me. The vast masses, the luxurious colouring, the mingled associations of great mountain scenery, amaze, excite, overwhelm, or exhaust—but too seldom teach; the mind cannot choose where to begin. But Derbyshire is a lovely child's alphabet—an alluring first lesson in all that's admirable, and powerful chiefly in the way in which it engages and fixes the attention. On its miniature cliffs a dark ivy leaf detaches itself as an object of importance; you distinguish with interest the species of mosses on the top; you count, like many falling diamonds, the magical drops of its petrifying well; the cluster of violets in the shade is an Armida's garden to you. And the grace of it all, and the suddenness of its enchanted changes and terrorless grotesque—grotesque par excellence! It was a meadow a minute ago, now it is a cliff, and in an instant is a cave—and here was a brooklet and now it is a whisper underground; turn but the corner of a path and it is a little green lake of incredible crystal; and if the trout in it lifted up their heads and talked to you, you would be no more surprised than if it were in the 'Arabian Nights.'"

As regards its architecture, though it is true that Derbyshire possesses no grand and imposing cathedral or castle of the first rank, it can boast of one or two of perhaps the finest old houses existing in England—notably, Haddon Hall—whilst the great diversity of style to be studied in its fine series of parish churches, ranging from the Saxon crypt at Repton, through the various styles of Norman, Early English, Decorated, and Perpendicular—at Melbourne, Ashbourne, Tideswell, &c.—down to the more recent work of Gibbs at All Saints' Church, Derby, make it a very desirable country for the holiday-making strolling sketcher and architectural student.

For the southern portion of the county, Derby—which is the headquarters of the Midland Railway Company—makes a good centre, its railway facilities being excellent. Here we find a town which dates far back in the annals of English history—a town which was a Royal borough in the time of Edward the Confessor, which has enjoyed Parliamentary representation since Edward I. ascended the throne, and where are still to be seen those signs of its past history; although, considering the conservative influence which is supposed to be so strong in these old-time places, Derby has a wonderfully new and fresh appearance. On the details of its architecture it is not necessary to dwell, as the town and its buildings were fully described and largely illustrated in the article in the *Builder* of July 17, 1897, forming No. VIII. of the series on "The Architecture of our Large Provincial Towns."

Our first excursion from Derby was to the pretty village of Breadsall, two miles to the north-west, where the train drops you down in sight of the red brick, tile and thatch covered cottages, which nestle in the wooded hollow, dominated by the beautiful spire of the church, which forms a conspicuous landmark. The church (fig. 1) consists of a chancel, nave with north aisle, south porch, and a tower and spire, and is of much interest. The earliest portion is the south doorway to the nave, which is of Late Norman character. The arcade, of three bays, is Early English or Transitional work, which is the date of the

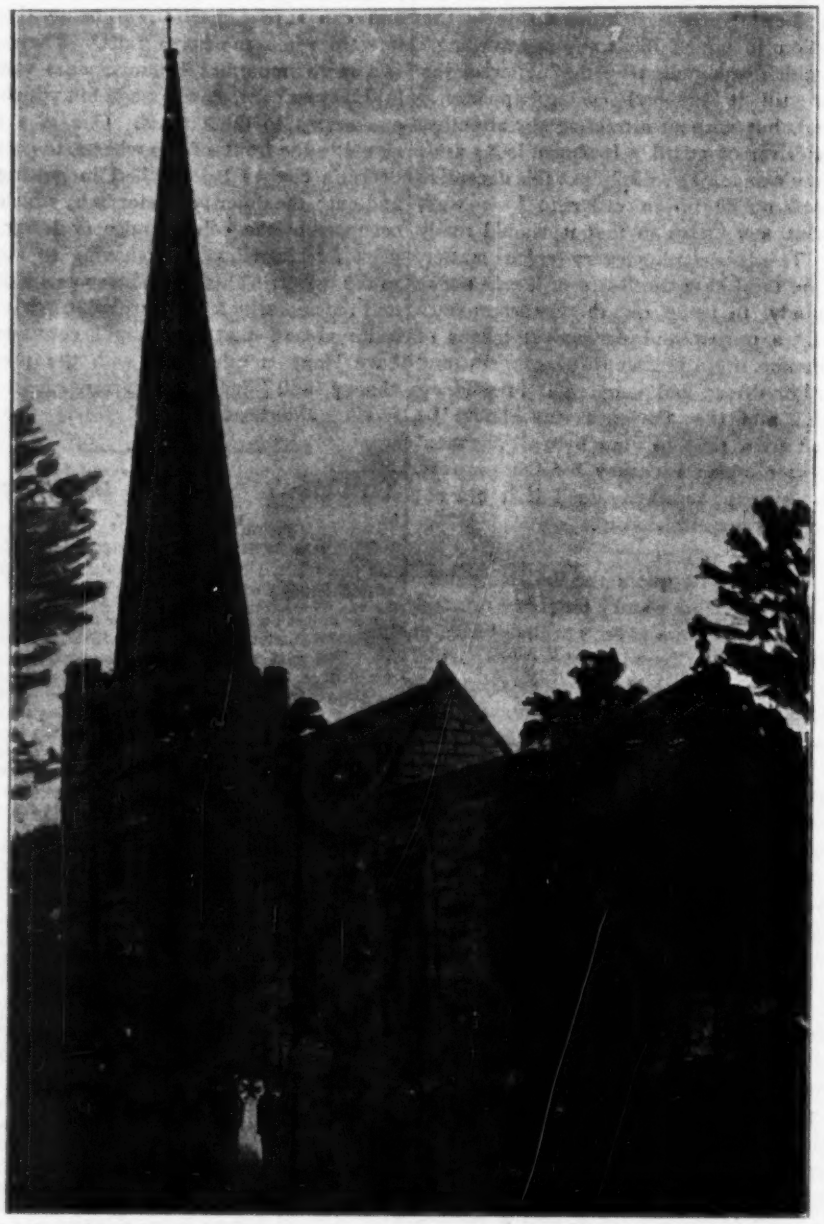


Fig. 1.—Breadsall Church. (Sketched by J. Tarney.)

church generally. At the east end of the north aisle is a "squint," from the aisle to the chancel, above which is another opening in the wall, with steps, which gave access to a rood screen, the remains of which are said to be stowed away in the tower. The lancet window on the north side of the chancel has a curious corbel feature to the inner arch. The three three-light square-headed windows on the south side have a good effect, and are very similar to the work at Tideswell and Lichfield Cathedral. They are possibly all by the same hand, and are insertions of the Decorated period. The east window is Perpendicular, and of five lights. The label termination is a moulded corbel, also found in the two-light south chancel window and in the nave clearstory at the neighbouring church at Morley. The chancel arch is modern, and of a poor type. The fine sedilia of three bays on the south side were discovered during some alterations, having been covered by plaster and whitewash for years. They have been cleaned, and are in a well-preserved state. The church has a font of the Decorated period, and some ancient bench-ends of oak.

Facing the north side of the church, on the opposite side of the road is a picturesque old building, formerly the old Hall, but now used as the village post-office (fig. 2). Standing in a sort of paddock, with its old garden in front, it makes a very delightful group with the church and surrounding trees. It appears to have been restored, and the doorway removed from the side to the end gable; probably, also, the roof was originally of thatch. The good, old-fashioned English inn was here conspicuous by its absence, and we were compelled to forage amongst the cottages for our lunch. We fared little better at the neighbouring village of Morley, where the modest inn formed a marked contrast to, say, the Peacock at Rowsley, or the Green Man, of Boswell fame, at Ashbourne. However, our visit to the charming little church fully compensated us. Here the vicar's interest is apparent in the visitors' book, an interesting volume containing signatures of visitors from all parts of the world, and also in the printed cards placed about, which give a synopsis of the history of the fabric. The surroundings of the church add greatly to its charm; the trees, roses, and masses of honeysuckle being very profuse, whilst the general picturesqueness was further added to by two peacocks, which were strutting about upon the leads of the aisle. The church probably consisted originally of the present nave, with an apsidal chancel. In the opinion of some the nave arches (Norman) were pierced through and support Saxon walls. The tower and spire and chancel are Decorated work, and were built by Goditha Stathum. The church is rich

Fig. 2.—The Post-Office, Breadsall. (Sketched by J. Tarney.)

Fig. 3.—Tutbury Church.

in monuments and brasses and old glass. There are nine brasses to the Stathum family, and from one of these it is interesting to find the date of the north aisle recorded as built by Ralph de Stathum (*temp.* Henry II.). In 1539 the windows of the refectory of the Abbey of Dale were purchased by Frances Pole, and inserted in the north aisle, which was at the same time enlarged; the nave clearstory windows were also added at this time. The aisle windows consist of a continuous row of four four-light windows divided by wide mullions and small buttresses on the outside. Two of these windows contain some very fine old glass, depicting the stories of "St. Robert of Knaresboro' and the Deer" and "The Story of the Holy Cross." In the lower portion are the arms of Dale, and the Pole, Bateman, and Sitwell families. The remaining lights are filled with modern glass following the old in style.

There is also some ancient glass in the south aisle and east end of the north aisle. In the north chapel is a stone effigy to Mrs. Babington, grandmother to Anthony Babington, executed in Elizabeth's reign, 1586. The floor of this chapel is paved with old tiles from Dale, many being of good design. There are no less than four piscinas in various parts of the church, the Decorated one in the north aisle grouping curiously with the squint which is cut through the respond into the chancel. Time did not permit of our sketching the Perpendicular arched tomb on the south side of the chancel, but we noted the chancel door, which is the smallest we have seen, being but 5 ft. 8 in. to the apex and less than 2 ft. wide—some clergy we wot of would find it rather inconvenient.

The porch door is said to have been brought from Dale Abbey, which seems to have suffered at the hands of the spoiler. Dr. Cox is of the opinion that the arch is of earlier date than the jamb, which is decorated—an opinion we shared.

Little remains of Dale Abbey except the arch of the great east window, 16 ft. wide and 40 ft. high, which was repaired some years ago out of the rates; the reason for this was the statement that the inhabitants would be exempt from the payment of tithes so long as the arch existed. The plan may be clearly traced by the remains. The style appears to have been Early Decorated throughout. There is a museum which contains some good specimens of tiles, which appear to have been made here in abundance. The church close by, principally Perpendicular in character, is of little interest.

Repton, of public school renown, situated between Derby and Burton, was the ancient capital of the kingdom of Mercia. The Black Priory was founded here in 1172 by Matilda, wife of Earl Randulph, on the site of a nunnery built before 663. There are numerous remains existing, mostly of the Decorated period, some being preserved in the buildings of the grammar school—founded in 1556 by Sir John Port—the main buildings of which were erected in 1886 from designs by Sir A. Blomfield. At the suppression of monasteries the Priory was sold to Thomas Thacker, whose son destroyed the whole of the structure except the porter's lodge, which had been converted into the family mansion. This was pulled down in the reign of William and Mary, and the hall, wherein much of the old work was incorporated, was erected on its site. The parish church, dedicated to St. Wystan, has many noteworthy features, especially the small chancel, with its peculiar crypt or underchancel of Saxon work. This is 17 ft. square, and appears to have had its vaulted roof and shafts inserted in Norman times. The church has a beautiful and delicate spire of Early Perpendicular work. The walls were raised slightly during the Early Decorated period, when the present four-light windows were inserted, the old portions of the nave arcade being of this date. There are a number of monuments to the Thacker family, and over the porch a parvise, in which is preserved an old parish chest.

A few miles east of Repton is Melbourne, where we find the church to be like a miniature Durham, and one of the finest Norman churches in the country. Dedicated to St. Michael, it is a cruciform structure, consisting of a chancel, central tower, north and south transepts, nave with aisles, and western portico flanked by two small towers. With the exception of the upper part of the tower and the eastern half of the chancel, the whole church is, in the main, of Norman work, *circa* 1120. The nave is separated from each aisle by five stilted arches 20 ft. high, resting on circular pillars 4 ft. in diameter on square bases.

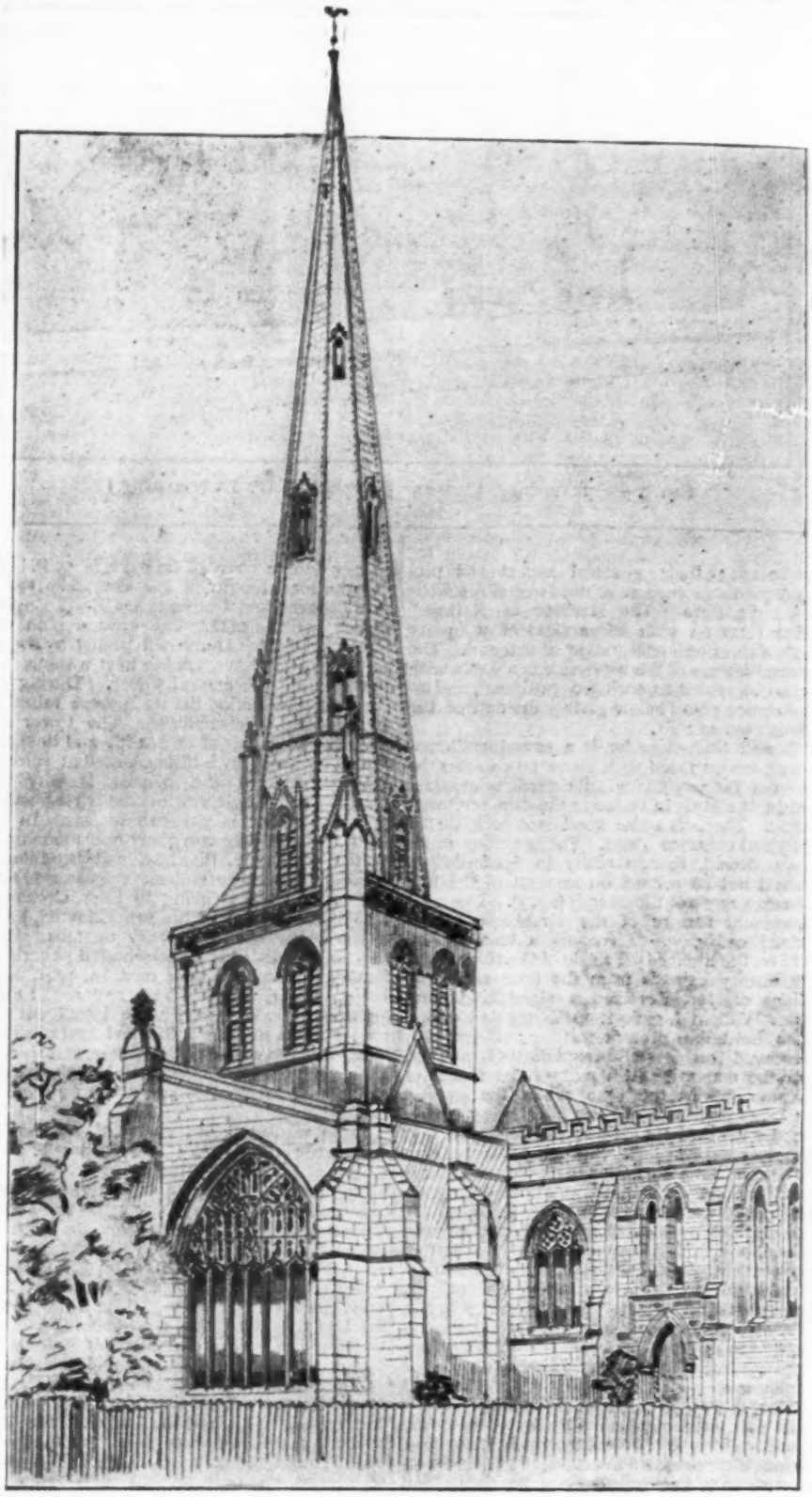


Fig. 4.—Ashbourne Church. (Sketched by W. T. Armstrong.)

Both transepts and the chancel once had eastern apses. There is evidence to show that over the groining of the chancel apse was an upper chamber, which it is conjectured may have been the separate chapel of a religious community, who may have had access to it through a doorway (still apparent) at the eastern end of the south wall of the south aisle, by the stairs in the south transept, and by the arcaded passages or triforium in the transept and in the south and eastern sides of the central tower. The upper portion of this tower is of later but uncertain date. There is a fine doorway at the west end of the church. The church was restored in 1862 by Sir G. Scott, at which time the small western towers received their present slated pyramidal roofs. Close by the church is a lake, twenty acres in extent, known as the Great Pool. On the opposite bank is a charming wood, from which you get a very picturesque grouping of the church and village, looking across the lake. Near this is the Hall, formerly the seat of Lord Melbourne, Prime Minister at the time of the Queen's accession. This was the Rectory at the time when the Bishops of Carlisle possessed the "living," and is additionally noteworthy as the place where Baxter wrote his "Saints' Rest." The gardens, which are trimly kept, are laid out in the Dutch style, and have a terrace of yew trees about eighty yards long.

At Etwall (on the Ashbourne line) we find a church which has some features of interest, notably the Gospel shelf on the north side of the chancel; the founder of Repton School is also buried here. Adjoining the church is a quaint group of almshouses whose mellowed brick and tile form a fit subject for the artist, and one which Walker could have utilised to

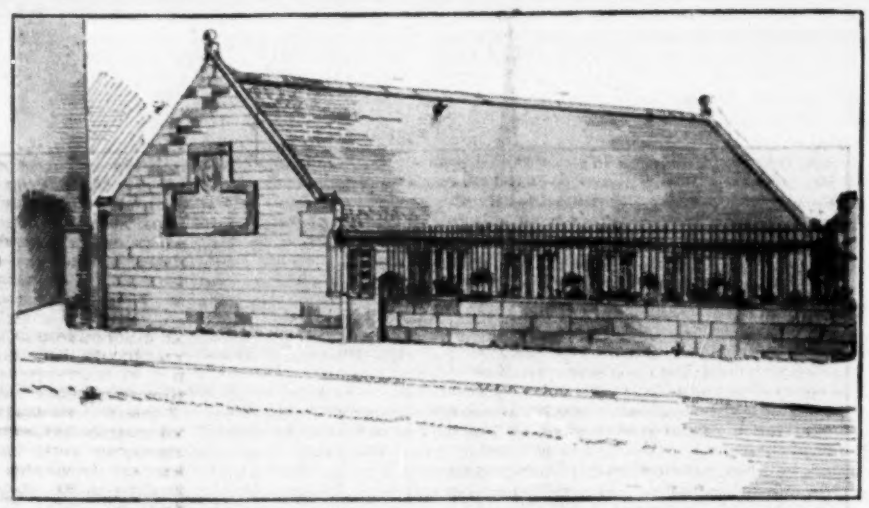


Fig. 5.—Almshouses, Ashbourne. (Sketched by W. T. Armstrong.)

advantage; their peaceful aspect and picturesqueness somehow remind one of his well-known picture "The Harbour of Refuge." They form on plan three sides of a square with a short projecting wing at one end. The central feature of the inner side is a gable with an archway and an enriched pediment, and an inscription panel below giving the date of the foundation as 1681.

Etwall Hall, close by, is a seventeenth-century mansion faced with stone taken from the ruins of Tutbury Castle. Its gardens are laid out in the style in vogue in the days of Queen Anne. There is some good ironwork in the rails and entrance gates. Tutbury, four miles from Etwall, though really in Staffordshire, should not be missed on account of the fine Norman work of the church (fig. 3). The most prominent feature of the landscape is the ruined castle, which crowns a well-wooded cliff on the Staffordshire side of the river Dove. Its history extends from the time when the Kings of Mercia erected a stronghold here. Then William I. gave it to Henry de Ferrars, who built the present fortress; Henry III. bestowed it on his son Edmund Earl of Lancaster, and the manor is still a part of the Duchy of Lancaster. At the time when the second earl was crossing the river after being driven out by Edward II., his war chest slipped into the river and was lost. Strange to say nothing was ever seen or heard of it from that time until 1831, when it was discovered during the deepening of the river's bed. Some of the coins, silver ones of the period, may now be seen in the British Museum. The chief portion now existing (it was dismantled by the Roundheads) are the gateway and part of the northern front built by John of Gaunt, wherein Mary Queen of Scots was imprisoned, the tilt-yard of three acres, and some buildings on the opposite side. A portion is now used as a farmhouse.

The church, dedicated to the Virgin Mary, was part of the Cluniac Priory built by the founder of the castle, below which it shelters. Principally Norman in style, it possesses an exceptionally fine west door of six orders, and about 20 ft. high to soffit of arch, and additions in nearly all later styles. The embattled tower of three stages is at the west end of the south aisle.

The old world town of Ashbourne, with its memories of Cotton and Izaak Walton and Johnson, is best left for a visit of two or three days, giving time for the exploration of Dovedale, a name which is synonymous for all that is lovely in English scenery. The town seems to grow inns like mushrooms, they crop up in every nook and corner, but the unrivalled advertisement given to the Green Man by Boswell, who praised the civility of its hostess, seems to have ensured it perpetual prosperity, if one may judge by the aspect of the outdoor larder (the ceiling of the gateway to the court-yard) which is pendent with game, &c., and quite reminiscent of old coaching days.

The parish church (fig. 4), locally known as the "Pride of the Peak" and dedicated to St. Oswald, occupies the site of a Norman church, is cruciform on plan, and consists of a chancel 65 ft. by 25 ft.; north and south transepts, which are double, being divided by piers and arches, 85 ft. by 40 ft.; and nave, with a south aisle or double nave. The nave is 55 ft. high, and the total length of the church is 180 ft. The chancel and transepts are Early English of date prior to 1241. The ground plan was completed in the Decorated period by the rebuilding of the nave, adding to it a south aisle and erecting the central tower. During the Perpendicular period the walls were raised by the addition of clearstories. The tower and spire rise to a height of 212 ft., and the staircase is crowned by a little crocketted spirelet. The interior of the church is lofty and spacious, and the view across the north transept from the tower is particularly fine. In the north transept aisle are many fine monuments to the Cockayne, Boothby, and Bradbourne families, mostly recumbent effigies on altar tombs, the earliest being to John Cockayne, who died in 1372, and his son Edmund, killed at the battle of Shrewsbury in 1404. Here also is Banks's, R.A., celebrated figure of Penelope Boothby, who died in 1791, aged seven. The church has been restored at three different periods, mostly in an intelligent and conservative manner; the last work undertaken was the repair of the tower and spire in 1894. The old bells are said to be the veritable peal which inspired Moore's "Those Evening Bells."

Some measured drawings of portions of Ashbourne Church, by Mr. Walter T. Armstrong, of Lancaster, will be found among the lithograph illustrations in the present number.

Lining the main street are many respectable old houses, including the house of Dr. Johnson's friend, the Rev. Dr. Taylor, with whom he was wont to stay when wearied of his favourite "walk down Fleet-street." There are also some plain almshouses (fig. 5), and the gabled front of the old Grammar School. A lesson may here be learned on "how not to do it" by a look at a certain modern chapel opposite.

There is a very interesting church and a manor house at Norbury, five miles south of Ashbourne. The latter belonged to the Fitzherberts (Lords Norbury) from the thirteenth century until recently, but there is not much of interest, the only ancient parts remaining being the south and east sides of the inner court, the latter part comprising the great hall. The church, dedicated to St. Mary, is of Late Decorated date, with some singular details, and is specially noteworthy for the number and beauty of its old monuments and early stained glass. Of the latter Dr. Cox remarks:—"There are not six parish churches in the kingdom that have so fine and extensive a display." On plan it consists of chancel, nave, north aisle, and tower, the latter being curiously placed between two chapels on the south side of the nave. The chancel, like those at Dronfield, Tideswell, and St. Peter's, Derby, is unusually large in proportion to the rest of the building, the nave being 49 ft. 3 in. long and the chancel 46 ft. 6 in. Among the unique features of its architecture may be instanced the capping to the buttresses, the wavy outline of the parapet, and the double flower of twelve petals which forms a boss at the intersection of the tracery of the windows, both inside and out. The interior of the north and south walls below the window string is occupied by a series of cinquefoil-headed arches or arcading, one of which, in south wall, forms a piscina. The church at Longford shows remains of the original Norman church, which were added to and altered in the fourteenth century. There are also some good monuments.

The new line from Buxton to Ashbourne, recently opened, may be utilised for visiting many pretty little villages in the vicinity. Thorpe, a charmingly seated little place with its houses clustered around the old church (dating from 1150); Fenny Bentley, where are the ruins of an old castle, now a farmhouse and a church, with screen and monuments; Tissington, a quiet village, with its old trees and wells, the latter of which are famous for their never-failing supply, which has given rise to the custom of "dressing" the wells with flowers on Ascension-day (this has been done ever since the time when these wells constituted the sole supply of the district during a long and trying drought). There is an old Hall belonging to the Fitzherberts, which was garrisoned for Charles during the Civil War, and contains some old panelling and a collection of fine pictures. Like many of the old Derbyshire halls, it does not offer much detail, but it is picturesque with its mullioned windows and gateway with broad steps. We suppose no rambling sketcher ever came into Derbyshire without visiting grand old Haddon, whose beauties are so well known, that it is needless to enlarge upon them afresh. Bakewell, whose church contains many monuments to the Vernon family, may be visited at the same time, being but some two miles away, and the charming meadow walk by the banks of the Wye may be taken to Rowsley, where the best of country inns, the Peacock, offers you a welcome, and is interesting enough in itself to find a place in your sketch-book.

J. T.

ASSOCIATION OF MUNICIPAL AND COUNTY ENGINEERS.

A HOME Counties district meeting of the members of the Association of Municipal and County Engineers was held at Tonbridge on Friday, September 14, and at Deal on the following day. The members attending the meeting assembled in the Council Chamber at Tonbridge Castle on Friday morning, where they were received and welcomed by Mr. W. Baldwin, Chairman, and members of the Urban District Council. Mr. W. Weaver, Kensington, Vice-President, presided in the absence of the President, and there were present:—Messrs. J. P. Barber, Islington; W. H. Savage, East Ham; J. C. Radford, Putney; J. P. Norrington, London; A. H. Campbell, East Ham; W. Harpur, Cardiff; A. D. Greatorex, West Bromwich; C. H. Cooper, Wimbledon; Cameron, Exeter; C. Smith, Sutton; W. Jones, Colwyn Bay; R. J. Thomas, Aylesbury; E. P. Hooley, Nottingham; W. Nisbet Blair, St. Pancras; H. Frost, Gosport; C. G. Lawson, Southgate; W. H. Leete, Bedford; O. E. Winter, Poplar; A. M. Fowler, Westminster; E. Willis, Willesden; J. Parker, Nottingham; and others.

Mr. J. R. Thomas, Aylesbury, County Surveyor of Buckingham, was re-elected Honorary District Secretary.

Mr. W. Laurence Bradley, C.E., Engineer and Surveyor to the Urban District Council, read a paper on "Municipal Work in Tonbridge." He said one of the most important and costly works undertaken by the Council was the High-street improvement, which had been carried out in pursuance of two provisional orders dated 1893 and 1895. The conversion of this wretched street as it existed previous to 1895 to its present condition had tended considerably towards the increased prosperity of the town. The street had been widened from a width in some places of only 28 ft. to an average width of 50 ft., and up to the present time a length of about 800 ft. had been completed, and the work of continuing the scheme was still in hand. As far as the road had been widened, the sum paid for the purchase of properties amounted to 25,482*l.* 2*s.* 11*d.*, and a sum of 8,156*l.* 10*s.* 5*d.* had been received for the sale of surplus land, making the net cost of the improvement for the purchase of the land 17,325*l.* 12*s.* 6*d.* The old property pulled down had a rateable value of 533*l.* The new property erected to the new building line had a rateable value of 1,944*l.*, showing an increase of rateable value owing to this scheme alone of 1,411*l.*, working out at 3*s.* 4*d.* in the pound at 235*l.* 3*s.* 4*d.*, which deducted from

690*l.* 14s. 4d. representing the repayment of principal and interest left a sum of 455*l.* 11s. as the net annual loss to the town, and which was only equal to a penny rate each half-year.

The main roads up to last year had been repaired with Penlee stone, but numerous complaints having been received as to the dangerous and slippery state of the roads in the winter time, the Council had commenced a trial of Quenast granite, and although its durability was hardly equal to the Penlee stone, he was of opinion that it was less slippery. For many years past patent Victoria stone had been used for paving the footpaths in the High-street, and as the improvements were carried out new 6 in. by 12 in. Norway granite kerb and solid granite slab channelling 18 in. wide was being laid. The sewerage of the town was carried out entirely on the separate system. The road and surface water was discharged into the river Medway, and the sewage was conveyed by two outfalls and discharged into receiving tanks at the farm, which was situated about half a mile east of the town. Sewer ventilation was originally obtained by means of surface gratings, but as complaints were continually being made of the smells arising therefrom they had been abolished, and 6-in. iron shafts fixed to convenient adjacent houses had been substituted with good results. The sewage was treated by three methods—precipitation, bacteria tanks, and land treatment. The experimental bacteria bed was constructed in 1898 by utilising a portion of the old storm bed adjoining the precipitation tanks. The sewage was first roughly screened and passed rapidly through one of the precipitating tanks after a very slight admixture of alumino-ferric. The sewage was then received on to the bacteria bed, allowed to remain for two hours, emptied, and the filter left to aerate for two hours before refilling; thus three charges could be dealt with during the day and the bed left to aerate during the night, as no sewage-pumping whatever was done at the works between 5.30 p.m. and 7 a.m. The results had been very satisfactory, the effect being a better effluent than what was obtained from the land, and he had been instructed to prepare a second bed. The farm comprised 34 acres, the under portion being a stiff loam and the low-land alluvium on stiff clay. The expenditure on the farm this year was 371*l.* and the receipts 468*l.*, before making allowance for repayment of loan. A destructor scheme had been prepared, but it had been decided to leave it alone for the present. The refuse was now ridged and burnt in the open air. There was no difficulty in keeping the refuse burning all the year round, thus showing that there was a decided calorific value in it, and there was a great demand for clinker at 2s. 6d. per load. In 1897 the Council purchased Tonbridge Castle and grounds at 9,727*l.* as a Jubilee memorial. This year the Council commenced the use of the buildings as offices, Council-chamber, &c., the north-west portion of the grounds had been set aside for fire brigade station, electric-light works, depot, &c., and the remainder of the grounds were used as a public park or pleasure-ground. Tonbridge was one of the first of the smaller towns to adopt the Public Libraries Act, and at present a new free library and technical institute was in course of erection from the designs of Mr. J. H. Phillips, of Cardiff. The total cost with furnishing would be a little over 7,000*l.*

The Chairman in moving a vote of thanks to Mr. Bradley, said that a long experience of refuse collecting by the Council's own staff and by direct labour had convinced him that if the Council did the work they did it a great deal better, but that it cost more money. He could not help thinking that the system pursued of burning refuse in the open air was likely to cause complaint.

Mr. Knight, Mile End, who seconded, said that his experience of dust collection coincided with that of Mr. Weaver. There was a time when it was done in his district for 600*l.*, now it cost 4,000*l.* The quantity had largely increased and the quantity of useful dust had decreased. Some 12,000 tons a year he sifted and sent to the brickfields. That paid very well when he received 4s. 6d. a ton for it; now it was down to 2s. per ton. Forty loads a day he burnt in cells he had constructed himself on the principle of Siemens' regenerative furnace. He burnt that for 9d. per load. He started burning his refuse in the open air, as did Mr. Barber, of Islington, but they were stopped, although the nearest house was a quarter of a mile away. It was astonishing what a stench it created. As a road material he had found Guernsey one-third better than Quenast granite.

Mr. Brooks, Strood Rural, said he had no complaints respecting Penlee stone when well scavenged; if not well scavenged it became greasy.

Mr. J. Manley, Wokingham, expressed his surprise that alumino-ferric should be put in the tanks to encourage bacterial action. It seemed to him like opposing forces being set to work.

Mr. J. P. Barber, Islington, said it was always encouraging to see the work of a municipal engineer carried out in the thorough manner it was in Tonbridge. It was not the magnitude of work they wanted to see so much as character.

Mr. A. M. Fowler, Westminster, and the Chairman having spoken, the vote of thanks was accorded and acknowledged by Mr. Bradley, who briefly replied to the points raised in the discussion.

Mr. Horace Boot, Tunbridge Wells, contributed an interesting paper on "Electricity Supply for Lighting Tramways, with special reference to Small Towns." He said it might be taken as a general rule that it was much easier to supply large towns in a successful manner than small ones. At the present time a number of small towns were hesitating as to whether it would pay them to undertake the work themselves or to allow a company to commence operations. For large towns it was almost always advisable that the Local Authority should start their own undertaking both for lighting and traction purposes. The vexed question of a combination of power stations capable of supplying electric energy for tramways, motors, lighting, heating, and other industrial purposes had been discussed very frequently for the past two or three years. There was no doubt whatever that wherever it was possible there should be one power station to supply the whole area, and the policy of multiplying these power stations was incorrect from an economical as well as a practical point of view. An important point to bear in mind was the question of nuisances, as works of any magnitude could not be run without creating a certain amount of nuisance, such as smoke, vibration, and noise. There were, of course, conditions which arose in towns necessitating the adoption of more than one power house; but he was of opinion that the future would see the development of large areas in preference to little stations supplying power stations supplying large local areas. The advantages of such would be facilities for obtaining fuel, all nuisances localised to one spot, the advantage of water carriage with an adequate supply of water for condensing purposes, the small amount of labour required for one works to work successfully as compared with a number of small works, the advantage gained by having the staff in one place. The only objection that could be urged to it was the question of fire or total disablement of the works causing a complete stoppage of the supply. The employment of experts to advise was rather a vexed question, but for towns to commence operations without having the advantage of expert advice was suicidal, as a mistake made in the selection of a site would prove fatal to the undertaking. Many towns had started dust destructor works in combination with electricity works, and there was no doubt from the figures recently obtained from the various works throughout the country, a considerable saving in fuel, was effected by burning refuse; and it had been found that in the latest type of destructors, 1 lb. of refuse would evaporate ·79 lb. of water at 212 deg. F. With reference to outlay on works the following gives a rough idea of the amount of capital required:—2,000 8-candle power lamps or their equivalent, 8,000*l.*; 5,000 8-candle power lamps, 12,000*l.*; 10,000 lamps, 20,000*l.*; 20,000 lamps, 35,000*l.*; 40,000 lamps, 69,000*l.*; and 100,000 lamps, 170,000*l.* At Tunbridge Wells the price charged was based on the maximum demand system. For the first hour's supply the price was 6d. For units composed over and above this, the price was 3d. The relative prices obtained at Tunbridge Wells on this system from various classes of consumers was, public-houses and hotels, 3·9d. per unit; shops, 4·8d.; private houses, 4·89d.; offices, 6d.; and churches, 6d. per unit.

On the proposition of the Chairman, seconded by Mr. A. D. Greatorex, West Bromwich, a vote of thanks was accorded to Mr. Boot for his paper.

Mr. F. W. Ruck, County Surveyor of Kent, read a paper on the "Main Roads of Kent, their Maintenance and Repair." He said the efficient upkeep of the highways, and particularly of the main roads of a county, was of the greatest importance to the whole community. This was proved by the greater amount of traffic thrown upon the roads than formerly, which before they were properly maintained was carried by the various railway systems. The County Council of Kent, after full consideration, decided upon the system of open contracts for road maintenance with private firms and highway authorities. No alteration of system was made until 1893 when several members of the Council expressed a strong feeling that a portion, if not the whole, of the main roads within the county should be maintained under the direct control system. After due consideration, it was decided in that year to adopt it in the eastern portion of the county lying beyond Canterbury and comprising 136 miles of main road, where the rural authorities had not submitted tenders to the extent to which it was hoped they would do.

This system was continued until the close of the year 1898-9, during which period it worked well, but did not show any marked advantage as compared with that of open contracts, which was then reverted to. There was in 1898 an endeavour upon the part of a section of the Council to place the maintenance and repair of the roads in the hands of the various District Councils, but under his supervision, when a Sub-Committee of the Council was appointed to take what action and obtain what information it thought necessary or desirable to enable it to report. Upon the report being presented, it was resolved to continue the contract system, which had in the past worked well. He was in favour of triennial contracts, which he has no doubt would be adopted shortly. It will be gathered that various opinions have from time to time been expressed on the question of the best system to be adopted in the county, and the systems had been thoroughly discussed, with the result that the system now obtaining had stood the test of the last ten years.

The county was originally divided into five divisions with an assistant-surveyor supplied to each, but these had now been reduced to four, with an average of about 150 miles in each, which were subdivided into fourteen sections. One of the principal features of the system was that of tendering for specified quantities of material which were clearly stated upon schedules giving the subsections upon which they would be required and the method of delivery.

The form of tender for each section was practically a schedule of prices giving the number of yards of each description of material to be delivered into depot on each sub-section, the material for footpaths, the carting from depot on to the road, and the rolling-in per cube yard, including watering and the supply of water. The whole of the manual labour, including the spreading of the material, was stated at a fixed sum for each sub-section. The specification required, in addition to the ordinary work of maintenance, that all the roads and footpaths through hamlets, villages, and towns should be swept every Saturday or at least once a week, thus securing a tidy appearance in populous districts. When any material was left in depot, the value of the labour in connexion with it that had been saved was deducted from the contract amount, and the contractor for the following year's contract was paid the usual rates for carting out and rolling, including 3d. per yard for spreading. The contractor had to provide, not a horse, but a water-cart for watering when and where required for consolidating the road surface in dry weather. The road ditches were cleaned out annually, the roads sided in the autumn and spring, and the weeds, long grass, &c., brushed from the sides of the margins and wastes before seeding. Any labour needed in excess of the permanent men was paid for as an extra. The materials used were Kentish rag, surface and grit flints, Sevenoaks (Chert) stone, gravel, and Cherbourg quartzile. Cherbourg quartzite was more largely used than any other material, particularly where the traffic was heavy, or where there was an absence of local material, it being more economical to use the more durable material and thus save haulage as far as possible. The Council had from the first, very wisely rolled the whole of the

material spread upon the roads. As the heavy repairs were completed during the five winter months, it necessitated the employment of between thirty and forty rollers at the same time. The advent of the road scarifier at a very opportune period had proved a great boon to the roadmaker. In his opinion the simplest and most handy form of the scarifier was that attached to the steam-roller. The proper use of the scarifier rendered it possible to economise the material, a much smaller quantity being required to reline the surface than under the old system. The work had hitherto been paid for by the yard superficial, which had cost about 1d. The following sums had been expended under the various heads during the last six years:—Footpaths, 11,639*l.*; improvements, 4,795*l.*; depots, 726*l.*; drains, 4,937*l.*; fences, &c., 1,071*l.*; milemarks, &c., 384*l.*; giving an average annual expenditure of 3,923*l.* It was generally known that the Kent roads cost considerably more than those in other counties, which was not surprising when all the facts were taken into consideration. In Kent there was an immense traction-engine traffic, there being no less than 122 licensed engines and 314 registered agricultural engines, all of the former being constantly upon the roads, the majority hauling heavy weights, and some employed in conveying road material into the adjoining counties. The great cost of the stone, nearly half the total quantity being procured from France, and the high rate of wages ruling throughout the county and particularly near the Metropolitan area, were also facts which should be borne in mind when considering the matter.

The Chairman moved a vote of thanks to Mr. Ruck for the paper, which he said would be of great value to County Surveyors in comparing the work in different counties as to its cost and method of execution.

Mr. Knight, Mile End, who seconded, said the paper was one which he had been looking forward to for years, in giving the cost of maintaining roads in rural districts. His experience had been exclusively Metropolitan, and the figures given had completely upset all his ideas as to cost.

Mr. Brooks, Strood Rural, said that while he found the contract system could provide the labour cheaper he found that with his own system of direct labour he was on the best side. His Council objected to the employment of good gangers, and consequently Mr. Ruck had a better system of supervision than they had with merely road foremen.

Mr. W. Blair, St. Pancras, thought the attaching of a road scarifier to a steam-roller was likely to have a serious effect on the life of the roller.

Mr. R. J. Thomas, County Surveyor of Buckingham, said that Kent had a unique system of advertising and letting the road work by public contract. There was no other county which had this system.

Mr. Leet, County Surveyor of Bedford, said his experience of a scarifier attached to a 10-ton roller was that it materially shook the engine, loosened the bolts, and upset the bearings. He would strongly advise any one purchasing a roller for scarifying purposes not to purchase one of less than 15 tons.

Mr. Carr, Lewes, said he was the first to use quartzite in Sussex, and it far exceeded his expectations. As an all-round metal he considered it the best they could get in Sussex.

Mr. Ruck, in replying, said that the Kent roads cost a lot of money, but it must be borne in mind that they had a very heavy traffic. The number of traction engines using the roads was three times greater than any adjacent counties. With reference to the attaching of the scarifier to the roller, he put the question very straight to Messrs. Aveling & Porter, and they said there was not the slightest chance of damage resulting. The cost per mile for the roads of the whole county in 1897-8 was 111*l.* They hoped they would not increase their past expenditure, though their traffic was increasing year by year. With reference to road material he considered that quartzite would give a dryer surface and last as long as Guernsey.

On the proposition of the Chairman a vote of thanks was accorded to the Tonbridge Council for the use of the council chamber for the meeting.

The afternoon was devoted to visits to the Shone ejector stations, the sewage works, Southborough Isolation Hospital, Capel Isolation Hospital, and a drive through the hop gardens. On returning to Tonbridge tea was served on the Castle lawn, and in the evening the members dined together at the Rose and Crown Hotel.

On Saturday, September 15, the members visited Deal, where they were received and welcomed at the Town Hall by the Mayor and members of the Corporation. Mr. W. Weaver, Kensington, Vice-President, presided at the business meeting.

Mr. T. C. Golder, Borough Surveyor, read a paper on "Some Municipal Works in Deal." With reference to the sewerage system, he said that at present the two outfalls, being very low, were tide-locked at high water, and consequently, when heavy rains had fallen at high tide, the low-lying parts of the town had been flooded. With a view of doing away with this flooding, Mr. Baldwin Latham was carrying out new drainage works, which would probably be completed early next year. At the completion of the new works the sewerage of the borough would still be on the combined system, and the sewage would be conveyed by a new main sewer from the old outfalls northward to a pumping station, and be lifted into the covered tidal storage reservoir, from whence it would be conveyed after screening through the new outfall into the sea. The discharge of the sewage was arranged to commence at high water, just as the sea begins to recede, when the flood tide was at its strongest in a north-easterly direction, and it was estimated that the whole of the sewage would be discharged within two hours of high water. The total cost of the works would be about 43,000*l.* The sea defence works proposed by the late Mr. E. Case, comprised two sections of groynes numbering fourteen each, the first being 400 ft. long and 200 ft. apart, the second varying from 200 ft. to 300 ft. in length and spaced 300 ft. apart. The total length of these groynes was 5,600 ft., and a length of over 4,000 lineal feet had been erected up to the present. The principle under which these groynes were employed was the building up of the shore to the natural angle of repose, which took the form of a quarter of an ellipse, the actual form of the shore after a scouring tide. The groynes were low and of slight timber, generally not more than 2 ft. above the shore at their highest point. The object of their being low and away from a sea-wall was to prevent scouring by obstruction at high water. It was claimed that since August, 1898, a total of 58,678 tons of material had been accumulated by the groynes, and that low-water mark of ordinary spring tides had receded an average distance of 50 ft.

The Chairman moved a vote of thanks to Mr. Golder for his paper. He said that if the groyne work carried out at Deal would only stand, there was not the slightest doubt that it was a very economical way of dealing with the beach difficulty, and it prevented any disfigurement of the beach.

Mr. Nicholls, Folkestone, seconded the vote of thanks, which, after remarks by Mr. Jones, Colwyn Bay; Mr. Blair, St. Pancras; Mr. Knight, Mile End; and Mr. Campbell, East Ham, was carried.

The members were entertained to luncheon by the Mayor and Corporation, and visits were made to the Case groynes, the sewerage works, which are in course of construction, and the waterworks.

ARCHITECTURAL SOCIETIES.

ARCHITECTURAL ASSOCIATION OF IRELAND.—On the 15th inst. the Sketching Club of the Architectural Association of Ireland visited, by permission of the architect, Mr. A. Young, the new Presbyterian Church at Howth, recently opened for service. The party, numbering twenty, were conducted over the church by Mr. Small, the contractor. The interior decoration is of a simple and effective character. The walls are of granite roughly dressed, the dressings being of Bath stone. The treatment of the design has the merit of novelty for county Dublin, the church, with the adjoining manse, being most picturesquely grouped as seen from the Howth road. The members next proceeded to Howth Castle, thrown open for their inspection by the Earl of Howth. Much time was spent in examining the dining-room and hall, in the latter of which are many relics of the ancient abbey. The grounds were afterwards explored, a notable feature in which is the closely-cut beech hedge, of great height, so arranged in long avenues as to give charming glimpses of the surrounding scenery.

Illustrations.

CAPITAL FROM LIEGE CATHEDRAL.

THIS capital dates probably from about the end of the fifteenth century, and is one of a pair surmounting twisted columns of marble, which now support the jubé and organ.

The capitals are of exquisite craftsmanship. They are deeply undercut, with parts in full relief. Amidst the wreathed foliage are placed curiously conceived animal forms of various kinds.

It is said locally that they were made at Cologne and came from Notre Dame aux Fonts, and that, amongst other fragments of churches demolished during the Revolution, these columns were preserved and ultimately re-used in their present positions.

H. HILLIER.

LLOYD'S REGISTRY.

THIS building is being erected in Fenchurch-street, with a frontage of 144 ft. to Lloyd's-avenue, a new street leading from Fenchurch-street to Crutched Friars, and is to accommodate the large staff of "Lloyd's Register of British and Foreign Shipping," the well-known association of shipowners, underwriters, and others who undertake the surveying and classifying of nearly the whole of the mercantile shipping throughout the world.

The accommodation includes general offices for the secretary and his staff, surveyor's, engineer's, and draughtsman's rooms, committee-room, boardroom, and luncheon-room. There is also provided an ample library and a museum.

Portland stone is being used for the whole of the frontages. The staircase and entrance hall will be lined with Devonshire marble, and some of the rooms will be panelled in English oak or African mahogany.

Messrs. Mowlem & Co. are the general contractors, and Mr. T. E. Collcutt the architect.

MEASURED DETAILS FROM ASHBOURNE CHURCH.

THESE details of this well-known Derbyshire church were measured and drawn by Mr. Walter T. Armstrong, of Lancaster, and are lent to us for publication as a part illustration of Mr. J. Tarney's paper on "A Holiday in South Derbyshire," printed on another page, in the course of which Ashbourne Church is referred to and described.

BOOKS RECEIVED.

THE ROYAL TOMBS OF THE FIRST DYNASTY. Part I. By W. Flinders Petrie. (Kegan Paul & Co., and the Egypt Exploration Fund.)

ARCHÆOLOGICAL SURVEY OF EGYPT: SEVENTH MEMOIR. Beni Hassan; Part IV. (Kegan Paul & Co., and the Egypt Exploration Fund.)

GAS, OIL, AND AIR ENGINES. By Bryan Denkin. (C. Griffin & Co.)

Correspondence.

To the Editor of THE BUILDER.

TEAK.

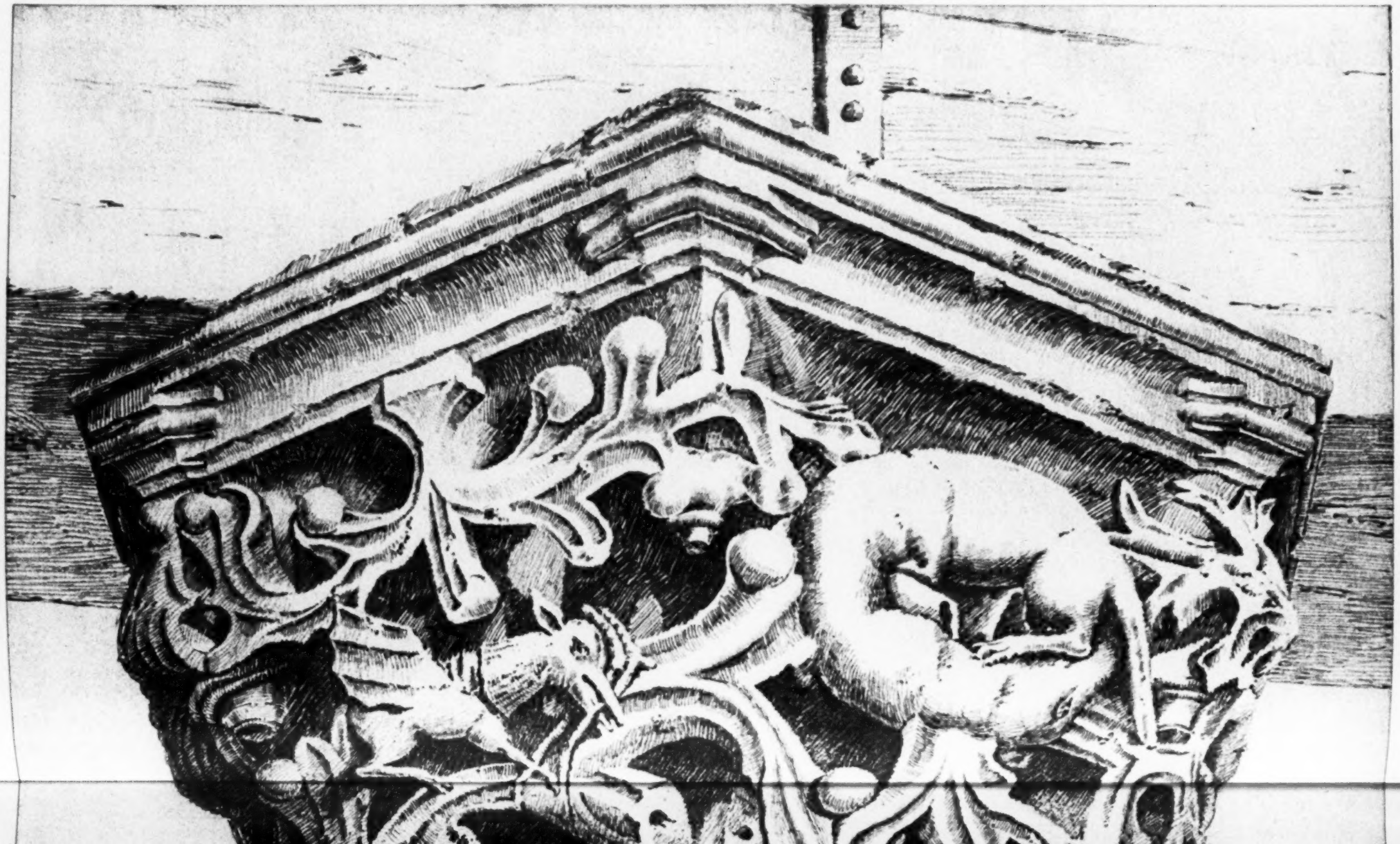
SIR,—In a recent book on specifications, published in England, the author, in speaking of teak, says:—"Teak from Moulmein is most suitable for joinery work, and from Johore for constructional work."

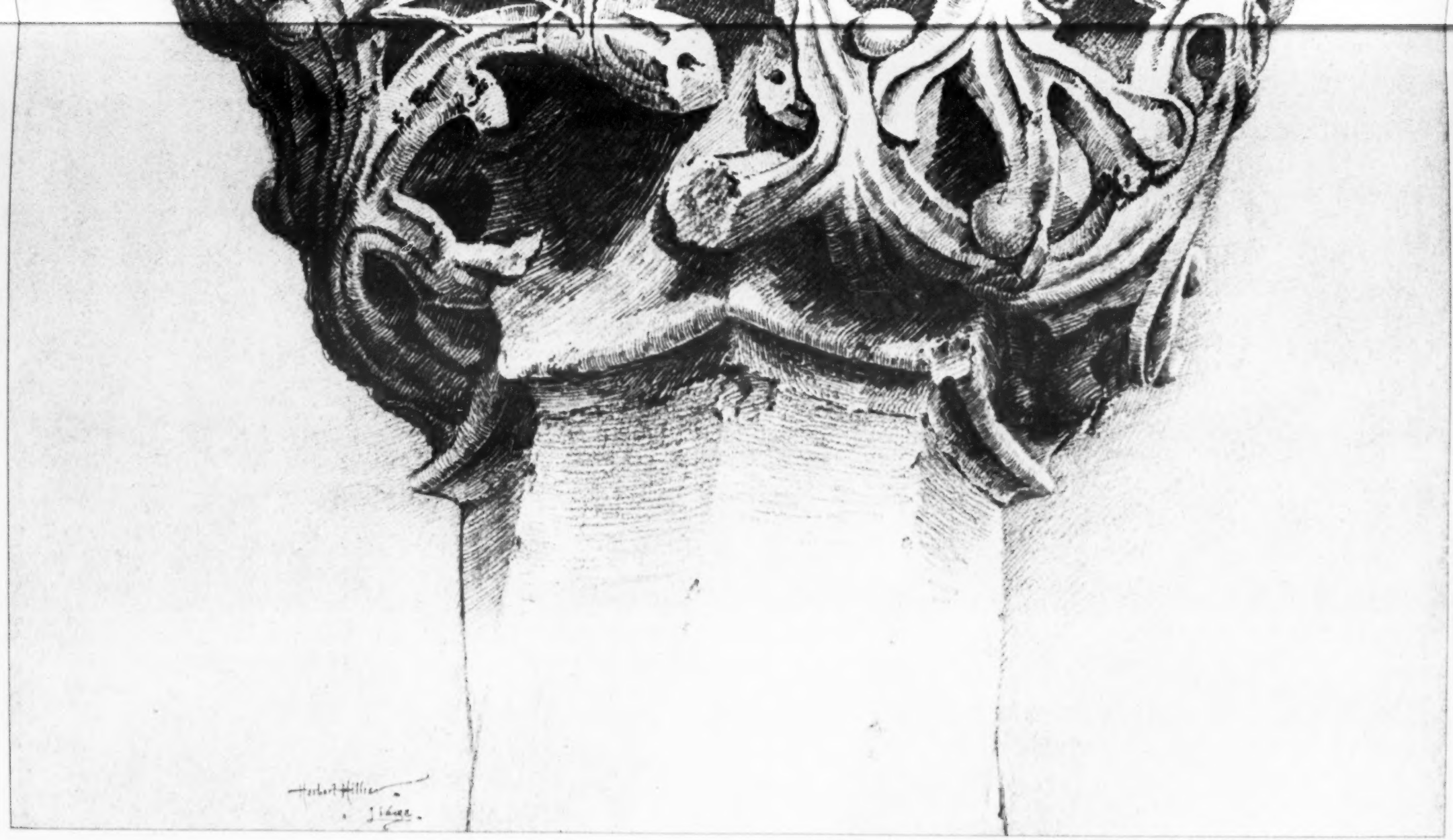
This is scarcely correct, as Johore does not produce teak; in fact, I think I am correct in saying that the only teak trees in the Malay Peninsula are a few that were planted some years ago on the hills in Perak, and these do not appear to do well.

The author does not mention the two principal ports exporting teak—Rangoon and Bangkok—both of which ship very much more than Moulmein.

From experience I should say, use Bangkok for constructional work, and Rangoon for joinery. Both are beautiful woods. ARCHITECT.

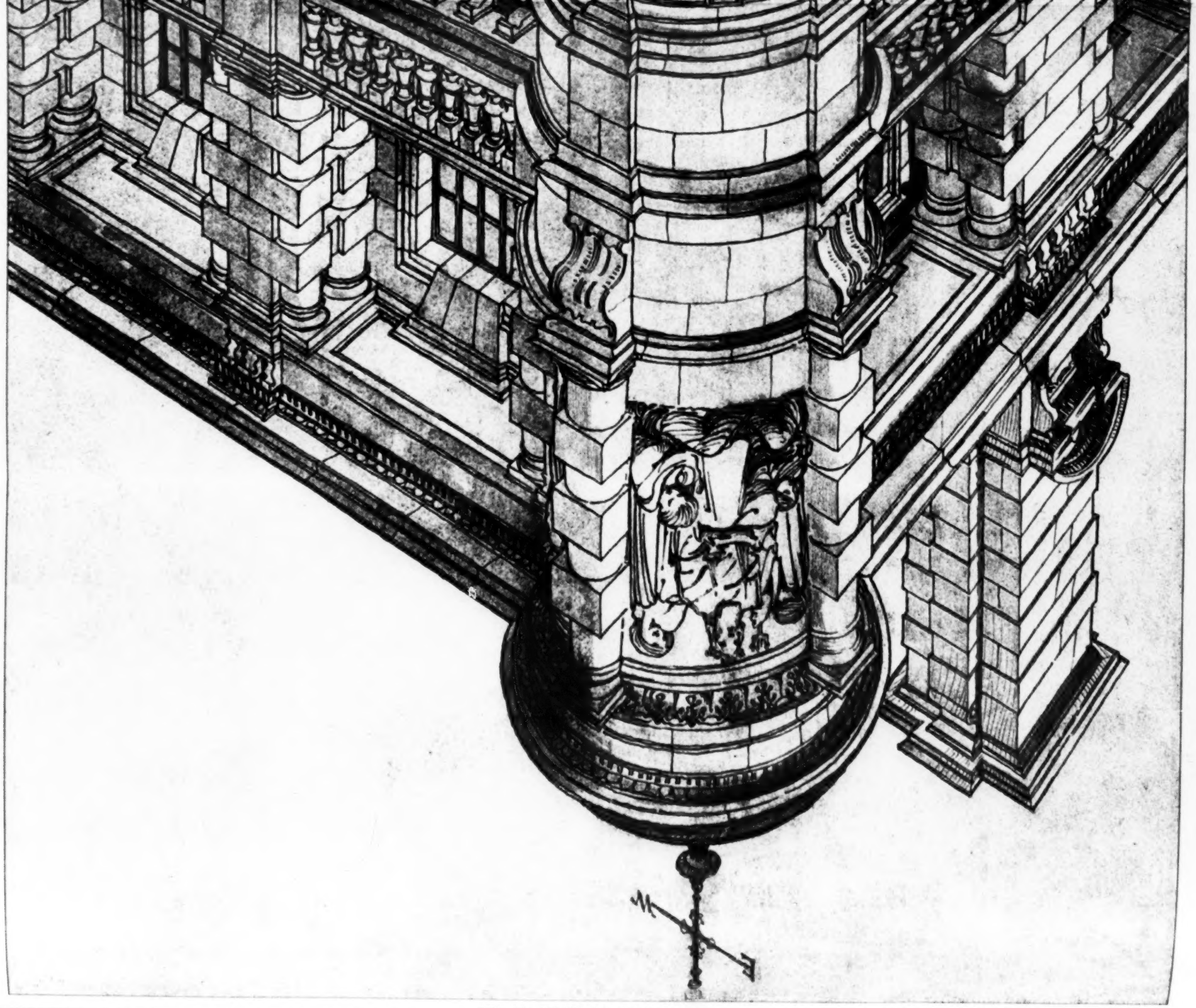
Singapore, August 9.

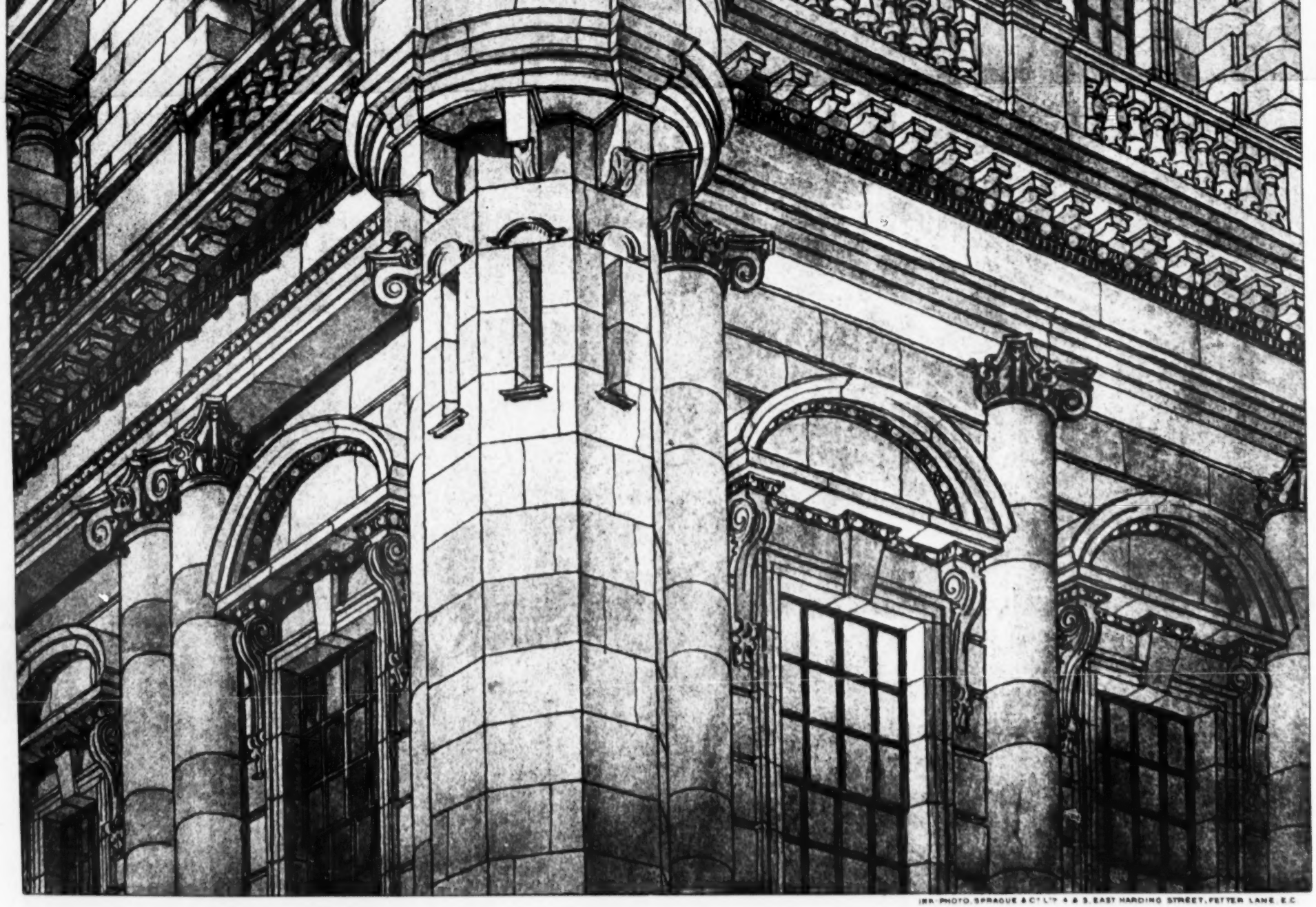




INK PHOTO LITHO LONDON E.C.

CAPITAL FROM LIEGE CATHEDRAL.—Drawn by Mr. Herbert Hillier.

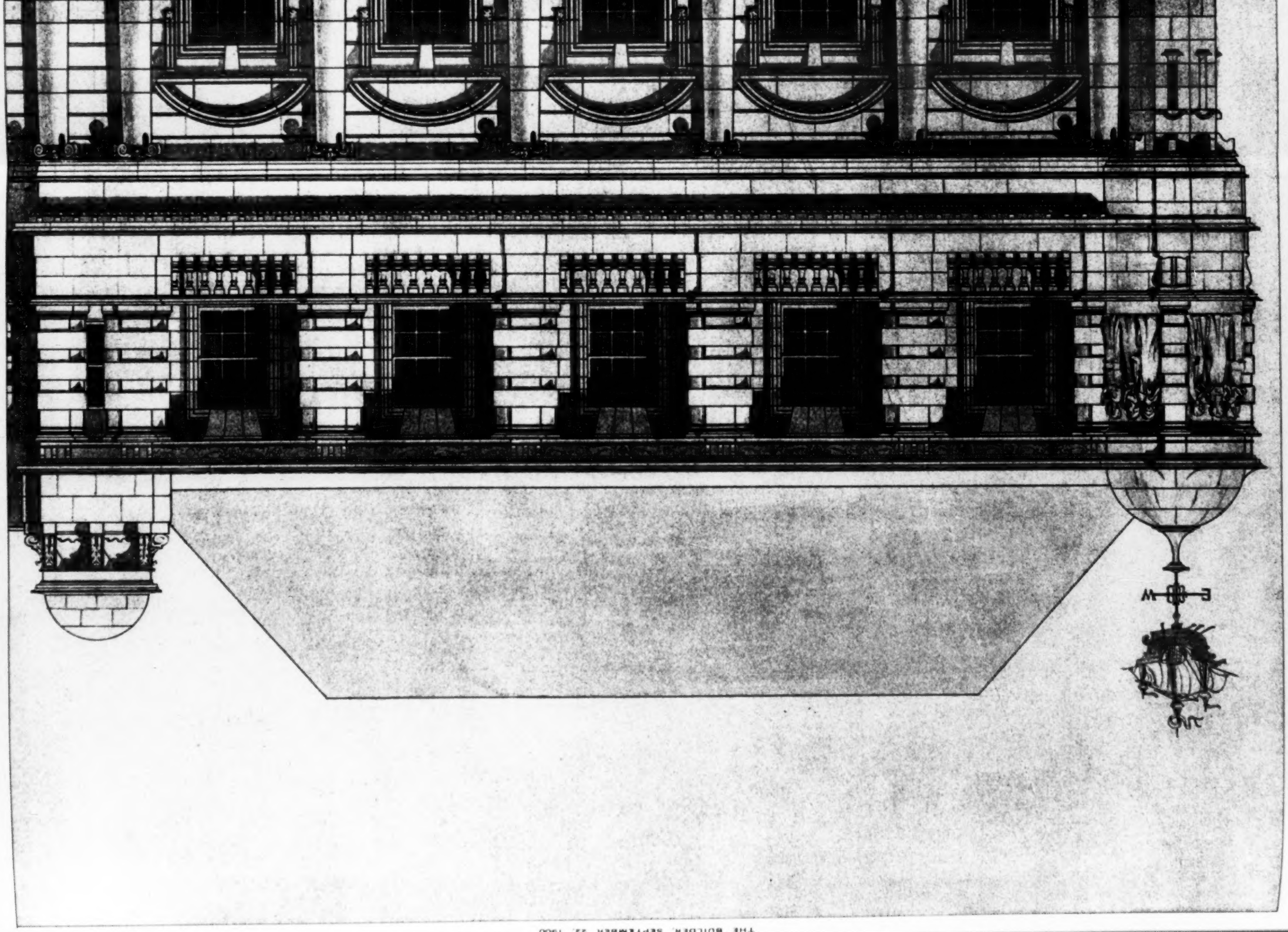


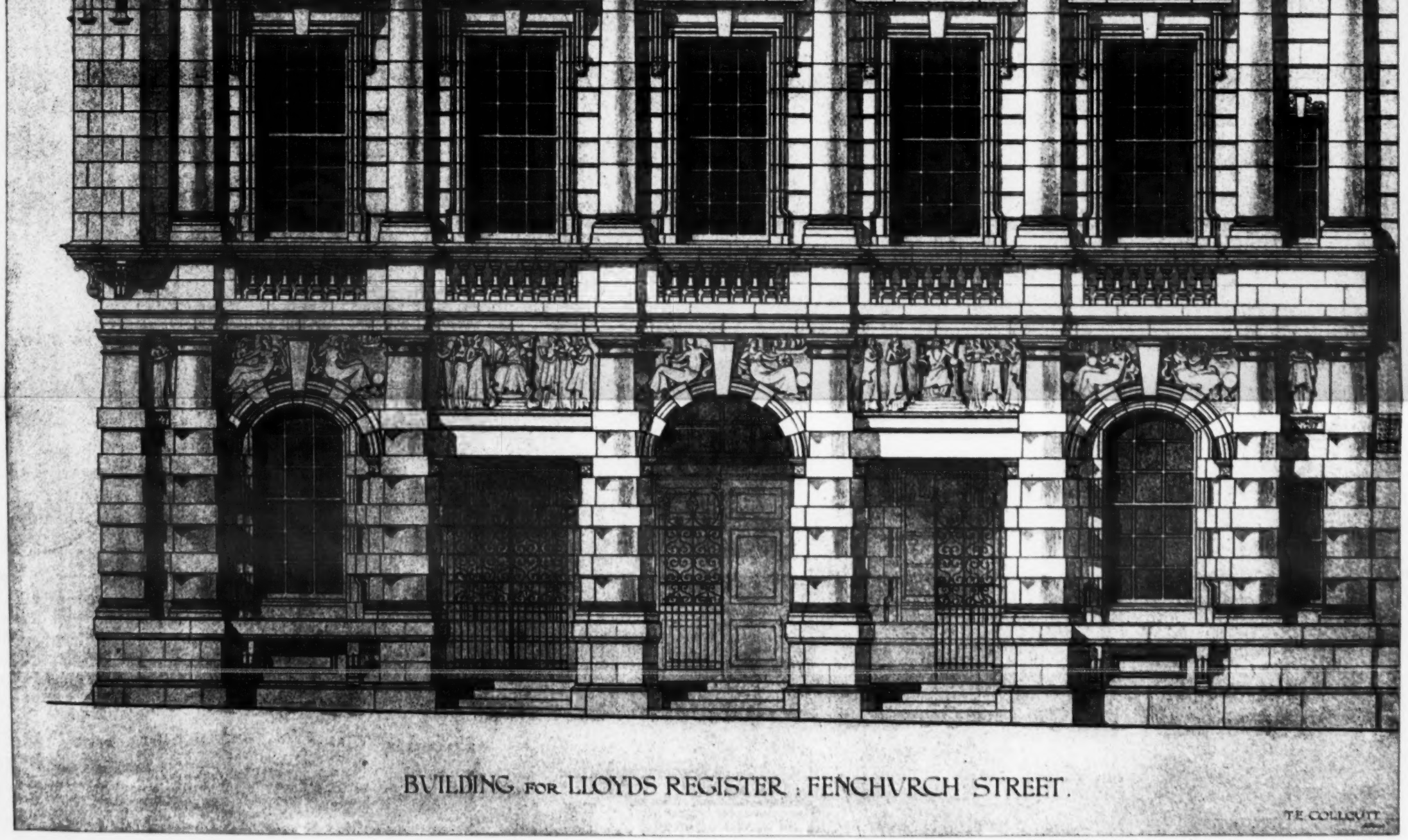


[illegible] PHOTO. SPRAGUE & Co LTD 4 & 5, EAST HARDING STREET, FETTER LANE, E.C.

LLOYD'S REGISTER OF SHIPPING, FENCHURCH STREET.—Mr. T. E. Collcutt, F.R.I.B.A., Architect

PERSPECTIVE VIEW OF ANGLE.

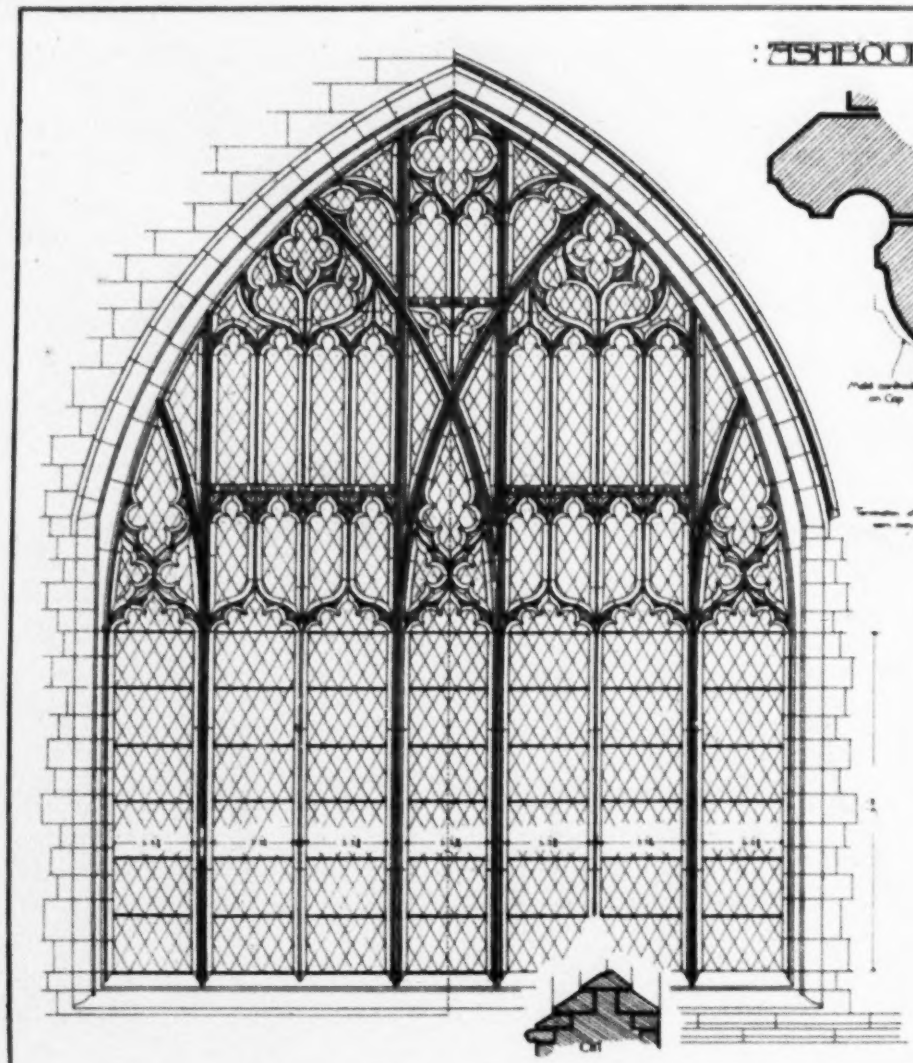




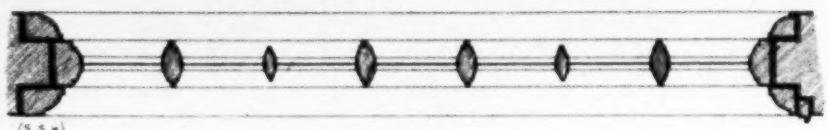
LLOYD'S REGISTER OF SHIPPING, FENCHURCH STREET.—Mr. T. E. Collcutt, F.R.I.B.A., Architect

ELEVATION.

ASHBOURNE CHURCH: Derbyshire.

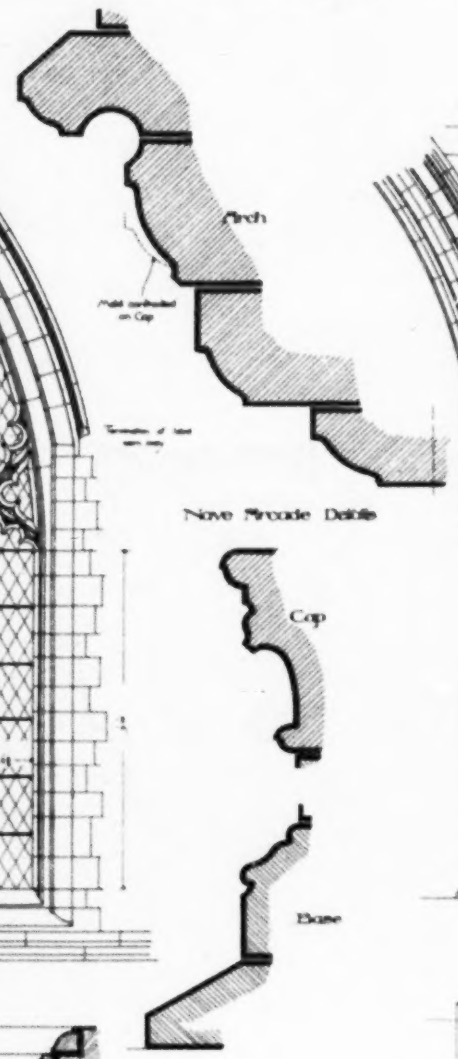


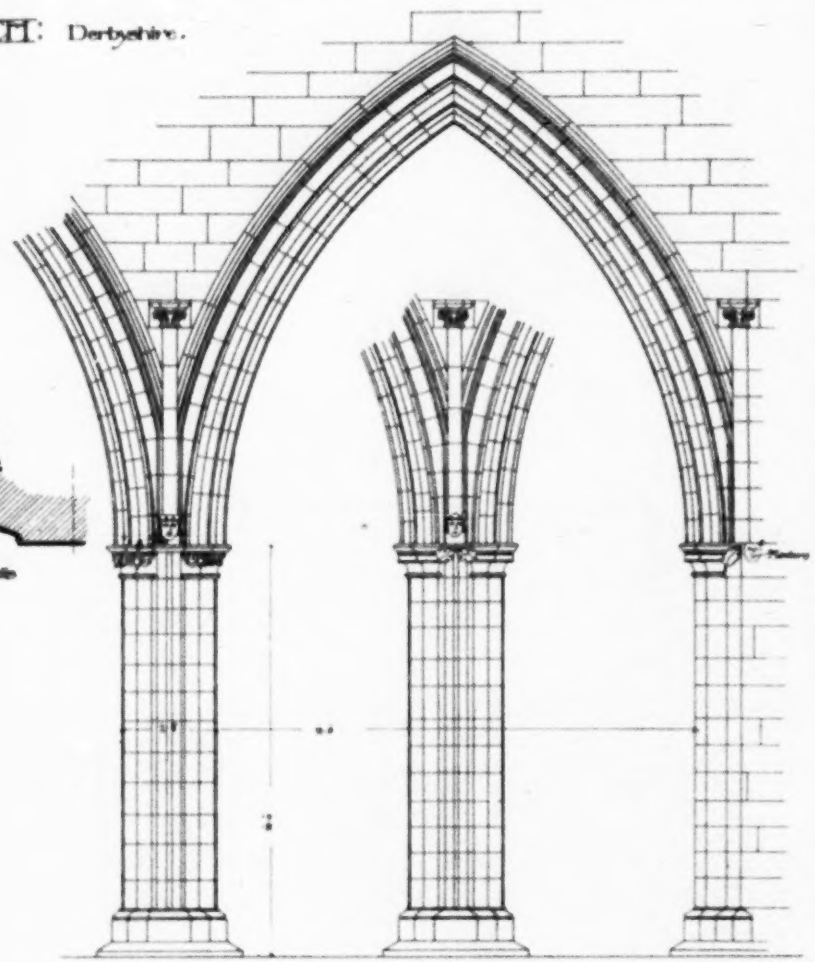
Inside Elevation Outside Elevation



Plan

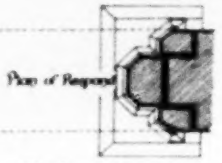
SOUTH TRANSEPT WINDOW





Elevation

Plan of Piers



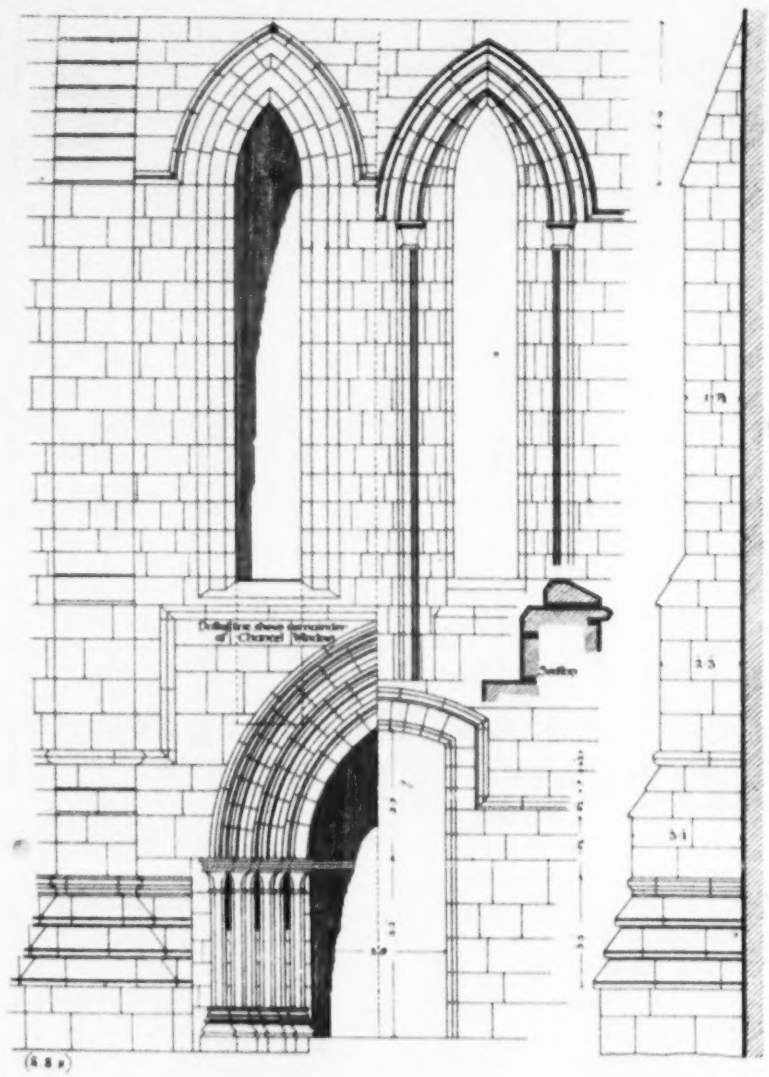
Measured & Drawn by

NAVE ARCADE

PHOTO-LITHO. SPRAGUE & CO., 47 & 48 EAST HARDING STREET FETTER LANE E.C.

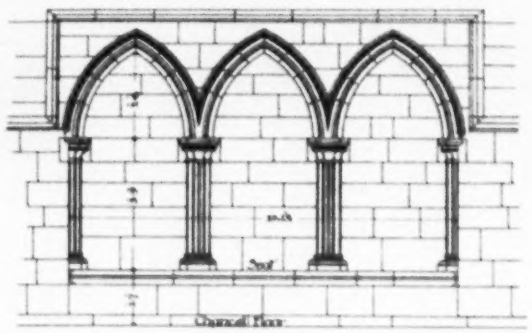
THE BUILDER, SEPTEMBER 22, 1900.

ASHBOURNE CHURCH: Derbyshire.

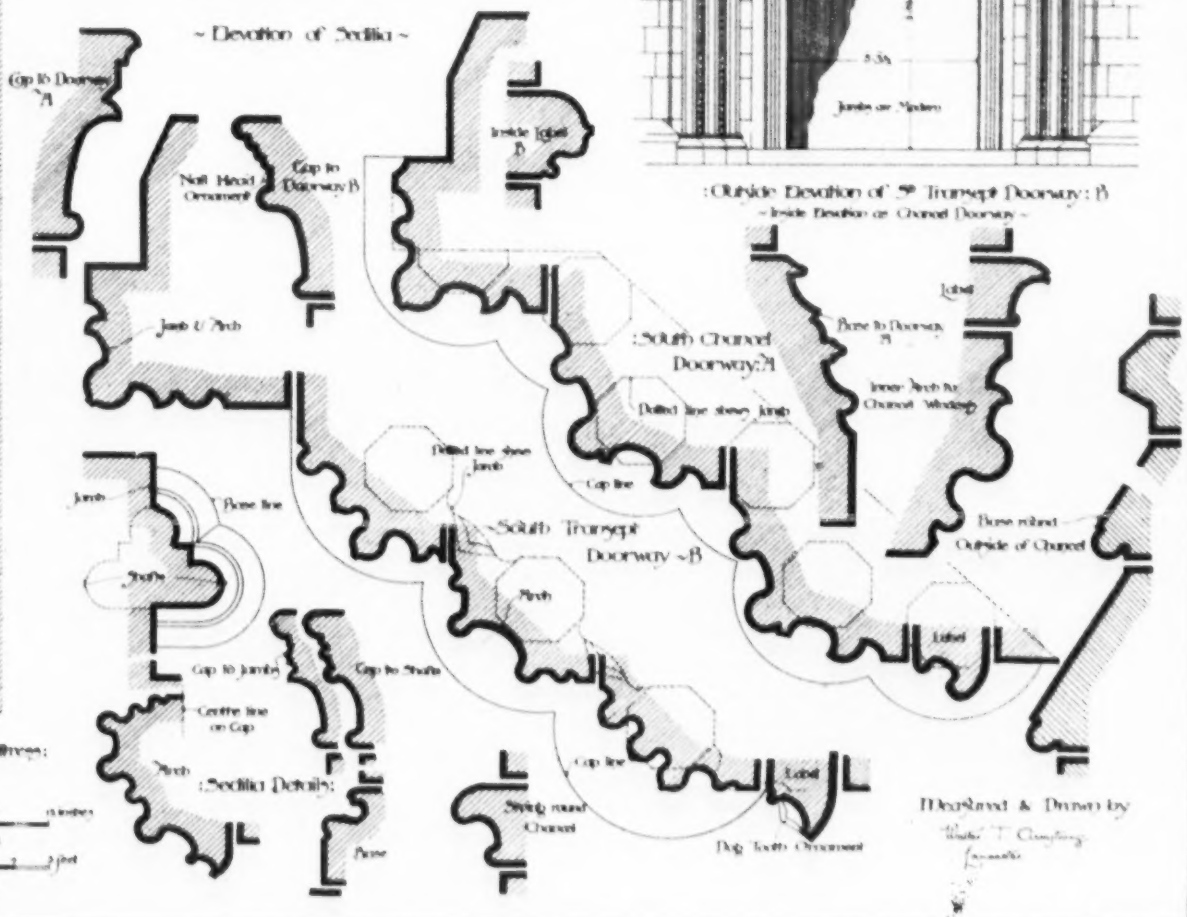


:Outside Elevation: — :Inside Elevation: :Side Elevation of Pillar:

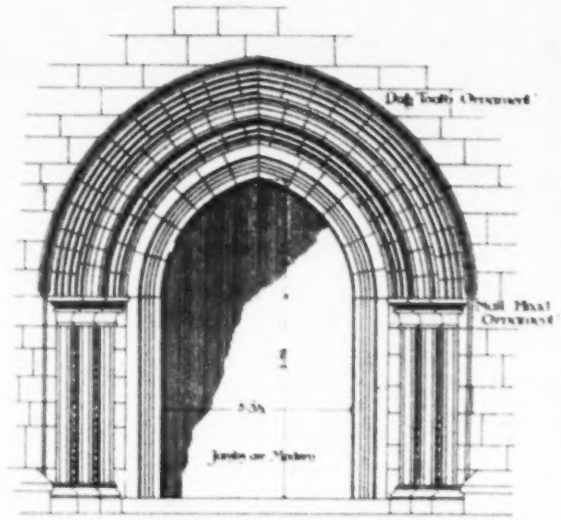
:ONE BAY OF CHANCEL:



~ Elevation of Sedilia ~



:Sedilia Details:



:Outside Elevation of S^th Transept Doorway: B

~ Inside Elevation of Chancel Doorway ~

:South Chancel Doorway: A

:South Transept Doorway ~B

Measured & Drawn by

PHOTO-LITHO SPRAGUE & C^o 47 & 48 EAST HARDING STREET FETTER LANE E.C.

The Student's Column.

LESSONS IN ELECTRICAL ENGINEERING.

II. CABLES. KELVIN'S LAW. DROP IN VOLTS. INSULATION. SYSTEMS OF DISTRIBUTION. POTENTIALS OF THE MAINS.

IN order to convey the electric power generated at the central station to the lamps or motors where it will be employed as light or power some form of conduit is necessary. Hydraulic power can be conveyed by water under high pressure in iron pipes, and mechanical power can be transmitted by an endless belt or chain. In like manner electric power can be conveyed by metal rods provided that means be adopted to prevent the electric current from escaping from them. To transmit electric power, therefore, we must provide a metal path for the current, and insulate this path so as to constrain the current to go in the required direction and pass through the necessary appliances.

Hitherto copper is the metal that has been most commonly employed as the conductor. In early telegraphic days it could not be obtained pure, and its conductivity was only about 30 per cent. of that of pure copper. Its breaking strength also was only about 50 per cent. of modern hard drawn copper. Hence there were numerous attempts made to increase its strength by having copper wires with iron cores, and to increase its conductivity by adding a silver core. Copper can now be obtained, by means of electrolytic methods, almost entirely free from any trace of alloy, and its conductivity is very little less than that of silver.

Recently, however, aluminium has become a rival to copper, and its smaller specific gravity makes it preferable for aërial conductors. Copper is 3·33 times as heavy as aluminium, and its conductivity is about one and a-half times greater. Therefore, for carrying a given current for a given loss in the wires aluminium will effect a saving of 50 per cent. in weight as compared to copper. The tensile strength of aluminium is about 87 per cent. of that of copper, but as it only has to support half the weight it has really the larger margin of safety, notwithstanding that its increased bulk makes it more exposed to wind pressure. If aluminium be only twice as dear as copper, then for electrical purposes there is little to choose between them. Copper at 90*l.* a ton or 10*d.* a pound is the equivalent of aluminium at 18*l.* a ton or 1*s.* 8*d.* a pound. In several large installations in America aluminium mains have been laid, and the refined metal employed stands exposure in a a damp atmosphere remarkably well, the oxide of aluminium, which forms a coating round the wire in these circumstances, being a harmless salt.

Electric lighting conductors may be either solid or stranded. In England the usual custom is to use no solid wire larger than No. 14 S.W.G. (0·080 in. in diameter) as cables consisting of thick wires are clumsy to handle. Most electricians would prefer to use a cable made up of seven strands of No. 23 wire to a cable consisting of one strand of No. 14 wire which would contain nearly the same amount of copper and carry approximately the same current. Such a cable is called a 7/23 cable. A 37/16 cable is a cable containing thirty seven strands of No. 16 wire. It is puzzling at first to find that the number of strands in a cable is always one or other of the following numbers :—

$$1, 3, 7, 19, 37, 61, 91, \ldots\ldots 3n^2+3n+1,$$

where n is the number of layers. With the exception of the three-strand cable the diameter of any cable is $2n+1$ times that of a single wire. A little consideration will show that these numbers are determined by symmetrical reasons. If we place a shilling on a table we can place round it six other shillings all touching the original shilling and the two adjacent ones. This is the section of a seven-strand cable. Arranging twelve more shillings round these seven we find that they all fit in neatly, and we get the section of a nineteen-strand cable. To surround the nineteen we require eighteen more, and so on.

A No. 20 wire will carry sufficient current for three 16 candle-power lamps at 200 volts. Therefore, a 7/20 cable will carry enough current for twenty-one 16 candle-power lamps, and a 19/20 cable will carry the current required by fifty-seven 16 candle-power lamps. It is found that stranded conductors have a slightly greater resistance than solid conductors which can carry the same current owing to the "lay" the manufacturers give to stranded cables. A lay of twenty times the pitch diameter is that most usually adopted. If very great flexibility is required a great many very small wires are used, sometimes even as many as three hundred. In concentric mains we have two co-axial cylinders of copper insulated from one another, the inner one being usually kept at the higher voltage as it can be better insulated from the earth and is better protected mechanically. Sometimes the mains consist merely of strips of copper laid in earthenware conduits. In this case special precautions have to be taken against water collecting in them.

Owing to the high price of copper and the great quantity of it required for the mains, it is a question of great importance to decide the proper weight to use. If the mains are too small in section for the current they have to carry then a large percentage of the total energy generated will be wasted in forcing the current through them, and the cost of generating the energy expended in heating the mains will be a large item in the annual coal bill. On the other hand, if the mains are too large then the annual cost of the energy wasted will be very small, but the interest to be paid on the initial cost of the mains added to the annual sum put aside for depreciation will be large. There is a certain size of main that will make the sum of the cost of the energy wasted per annum and the interest and depreciation on the initial cost a minimum. This is obviously the most economical conductor to use. Lord Kelvin solved this problem in a paper on "The Economy of Metal Conductors of Electricity" read to the British Association in 1881. He showed that the most economical conductor is that for which the interest and depreciation on the prime cost equals the annual cost of the energy wasted.

In practice the Kelvin law is complicated by the Board of Trade rule fixing the greatest permissible loss of volts in the mains as 4 per cent. of the volts at the station. In this case if Kelvin's solution gives a drop of ten volts, then the most economical system is the one giving the lowest permissible drop, *i.e.*, four volts.

The following example illustrates Kelvin's law. Suppose that the weight of copper in a "feeder" main in a power transmission scheme is ten tons, and suppose that 2,120,000 B.T. units are expended in it per annum, then, to find out whether the most economical amount of copper has been used in the main, we must know the price of copper per ton, the amount to be allowed for interest on the money expended and the amount necessary to save in order to allow for the depreciation of the main. In addition, we must know the cost of generating a B.T. unit at the power station. Let copper cost 80*l.* a ton, interest and depreciation together be 10 per cent., and the price of generating a unit be a penny. In the case considered—

Interest + depreciation = 80*l.*
Cost of energy wasted = 8,833*l.*
Therefore total annual cost = 8,913*l.*

If there had been x tons of copper, then—
Interest + depreciation = $8x$ pounds.
And the cost of the energy wasted

$$= \frac{21,200,000}{240x} \text{pounds.}$$

Now, by Kelvin's law, the most economical weight is got by equating these quantities, hence—

$$x^2 = \frac{21,200,000}{8 \times 240}$$

$$\therefore x = 105 \text{ tons.}$$

In this case interest + depreciation = 840*l.*,
And the cost of the energy wasted = 840*l.*
therefore the total annual cost would be only 1,680*l.* Hence by using 105 tons instead of 10 tons of copper an annual saving of 7,233*l.* would be effected. If we use more than 105 tons then the interest and depreciation item increases rapidly, and the total annual cost is more than 1,680*l.*

To calculate the loss in the electric pressure due to the resistance of the mains is simple. For example, suppose we have two conductors—one for the outgoing and the other for the return current—and suppose that they supply current to 800 lamps rated as 100 volt, 60 watt lamps, and that they are each 220 yards long and have a resistance of 0·0001 ohm per yard. The current each lamp takes is 0·6 of an ampere, and therefore the current in the mains is 480 amperes. The combined resistance of the mains is 0·044 of an ohm, and hence by Ohm's law the "drop in volts" is $480 \times 0{\cdot}044$, *i.e.*, 42·24 volts.

A useful fact to remember is that the resistance of a copper main one square inch in section and one mile long is 0·0455 ohm at 80 deg. Fahr. As an example we will find the "drop in volts" along a main 0·3 square inch in section and $2\frac{1}{2}$ miles long which carries 200 amperes. The resistance of this main is

$$0{\cdot}0455 \times \frac{2\frac{1}{2}}{0{\cdot}3}, \text{ i.e., } 0{\cdot}334,$$

and hence the drop in volts $= 0{\cdot}334 \times 200 = 66{\cdot}8$.

In order to prevent the current taking a short cut back to the generating apparatus before it goes through the receiving apparatus we must insulate the mains. If we are using high pressures it is also necessary to insulate the mains so as to prevent the possibility of an accidental shock. With very high pressures also we must insulate in order to prevent a disruptive discharge taking place. For example, if two bare wires at a pressure of 10,000 volts be brought within one millimetre of one another, then an arc will start between the two. Cables are insulated either by a material like india-rubber, which does not absorb moisture readily, or by a fibrous material protected by a water-tight envelope.

Sir William Preece gives the following table of the relative insulating powers of various materials :—

Air	Infinite.
Paraffin	38
Ebonite	28
Glass	20
India-rubber	10·9
Shellac	9
Gutta-percha	0·45
Mica	0·084
Ordinary paper	0·005
Siemens' high insulation rubber	16·17
Fowler-Waring dielectric	7·33

The numbers after the various substances give the resistance in megohms of a cube of the substance whose edge equals in length a quarter of the circumference of the earth. It is necessary to take this enormous cube in order to get small numbers. Sir William Preece calls this resistance the "specific insulation" of the material and denotes it by σ. In this country the insulation resistance of the dielectric round the main is given in megohms per statute mile. In order to find the specific insulation of the dielectric the following formula is used :—

$$\sigma \log \frac{r_1}{r_2} = R \times 4{\cdot}39 \times 10^{-4}$$

where R is the resistance in megohms of a mile of the main, and r_1 and r_2 the outer and inner radii of the insulating covering.

We find from a maker's catalogue that the insulation resistance of a mile of cable is 1,000 megohms, and the radius of the copper is 0·4 in., and of the insulating covering 0·97 in. Applying the above formula, we find that σ is 1·14. The above formula also applies to concentric mains. For example, the insulation resistance between the outer and inner conductor of a Ferranti concentric main is 720 megohms per mile. The outer radius of the inner conductor is 0·406 in., and the inner radius of the outer conductor is 0·922 in. Substituting in the formula we find that σ is 0·8876. The insulating material consists of compressed brown paper and black wax, which has therefore double the insulating power of gutta-percha.

In order to test the insulation resistance of a coil of cable it is placed in a tub of water, and the flow of current through the dielectric when the copper is kept at a high potential is measured by a sensitive mirror galvanometer. This flow, however, is not constant, but varies with the time. As a rule, the longer the pressure has been applied the less the flow. For this reason it is a recognised convention that the resistance to flow is to be measured one minute after the electric pressure has been applied. The resistance also varies with the pressure applied. The apparent resistance is better the higher the pressure. For example, the resistance of a cable after one minute's electrification in a tub containing water at 60 deg. Fahr. was 164 megohms when the testing pressure was 15 volts, but it was 174 megohms when the pressure was 600 volts. If the pressure that the cable will have to withstand in practice be V volts, then it is

customary to use 1·5 V volts as the testing pressure.

The methods of distributing electric energy from central stations may be divided into four groups :—

1. Distribution by continuous currents.
2. Distribution by alternating currents.
3. Distribution by polyphase currents.
4. Distribution by a combination of alternating and direct currents.

The simplest method of distributing by continuous currents is to use only two wires for the mains, and to keep the electric pressure between these two wires constant by means of a dynamo, whatever the number of lamps connected between them may be. Since power is the product of current and pressure, it is obvious that the higher the pressure the less the current, and, therefore, the smaller the mains required to distribute a given amount of power. If we double the pressure we halve the current, and therefore halve the amount of copper required. For this reason using high pressure diminishes the first cost.

As a rule in a two-wire system the mains, the dynamo, and the lamp circuits are all insulated from earth. The potential between the mains and earth is therefore determined by the insulation resistance of each main. If the difference of pressure between the mains be 200 volts, then if the positive main be connected to earth directly so that its insulation resistance is zero the potential of the positive main will be zero, and of the negative main −200. In this case we should get a severe shock if we touched the negative main, and a gas or water-pipe at the same time. If we earthed the negative main then the potentials would be +200 and 0 respectively. In this case the positive main would give a shock. If neither is earthed then the one with the highest insulation will have the highest numerical potential.

If f_1 and f_2 be the insulation resistances of the positive and negative mains and if x and $x-V$ be their potentials so that V is the difference of potential between them, then since the current leaking from one main to earth must equal the current flowing from the earth to the other main, we have by Ohm's law.

$$\frac{x}{f_1} = \frac{V-x}{f_2}$$

$$\therefore \frac{x}{f_1} + \frac{x-V}{f_2} = 0 \ldots\ldots\ldots\ldots (1)$$

This determines x the potential of the positive main, and the potential of the other will be $x-V$. Now, it follows by a well-known theorem in mathematics, that (1) is the condition that $\frac{x^2}{f_1} + \frac{(x-V)^2}{f_2}$ should have its minimum value. Hence, if the insulation resistances of the mains vary, the pressures of the mains from earth so adjust themselves, that the energy expended in leakage currents is a minimum.

An easy graphical construction follows from this which enables us to find readily the pressures of the mains from earth.

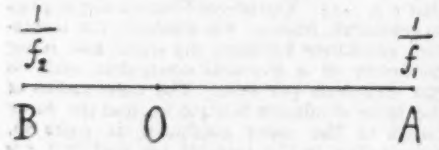


Fig 1

Find the centre of gravity O of masses $\frac{1}{f_1}$ and $\frac{1}{f_2}$ placed at a distance V apart (A B in figure), then O A is the potential of the positive main, and O B is the potential of the negative main.

In a three-wire direct current system we have two dynamos connected in series. The middle main is connected to their common terminal, and the outer mains to their other terminals. If each dynamo is giving 200 volts, then the pressure between either of the outer mains and the middle one is 200 volts and the pressure between the outers is 400. It is easy to see that if lamps be connected between the outers and the middle main, then the current in the middle main is only the difference between the currents in the two outers. If the loads on each side of the middle main be equal then there is no current in it, and we are virtually supplying at 400 volts, the lamps being in series with one another. In practice, the loads are so arranged that they are fairly well balanced on each side of the middle wire, and so it does not need to contain as much copper as either of the outers. A considerable saving in the initial expense of the mains can thus be secured by using a three-wire system.

In a five-wire direct current system we have four dynamos in series and five mains. In this country Manchester is the only town that uses this system, but it is a favourite one abroad. As the Board of Trade rules fix the pressures between the outers at 500 volts, and as 250-volt lamps can now be had, it seems probable that a three-wire system will always be the most economical. If we used a five-wire system, the pressure between adjacent mains would not exceed 125 volts.

It is important in five-wire systems to be able to see how the pressures of the mains from earth vary with their insulation resistances. An extension of the rule given above can be applied to this case. Place masses f_1, f_2, f_3, f_4, and f_5 at five equidistant points A B C D E. Find O the centre of gravity of these masses. Then O A, O B, O C, &c., will be the potentials of the mains if A B = B C = &c., represent the voltage between them. For example, let $f_1 = 100$ ohms, $f_2 = 50$, $f_3 = 100$, $f_4 = 12$, and $f_5 = 60$, and let 110 be the pressure between adjacent mains.

Let x be the potential of the positive outer which is represented by O A in figure 2.

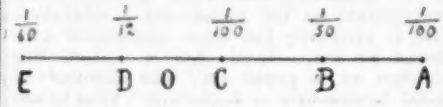


Fig 2

Taking moments about A, we have

$$\left(\frac{1}{100}+\frac{1}{50}+\frac{1}{100}+\frac{1}{12}+\frac{1}{60}\right)x = \frac{110}{50}+\frac{220}{100}+\frac{330}{12}+\frac{440}{60}$$

$$\therefore x = 280$$

Hence the potentials of the mains are +280, +170, +60 −50 and −160 respectively.

The second method of distributing electric energy is by alternating currents. The current is transformed up to a high pressure by means of transformers and transmitted to substations where the pressure is reduced by transformers which feed two or three-wire networks in the immediate neighbourhood. Distribution by polyphase currents is effected in a similar manner. A good example of the fourth method of distribution, that is, by a combination of direct and alternating, is afforded by the operation of the electric tramways at Buffalo. The motors in the cars get direct current at 500 volts from the trolley wire. The trolley wire gets its current from a rotary converter, which converts two-phase alternating. The two-phase alternating comes from a two to three-phase transformer, the pressure on the three-phase side being 11,000 volts. Following the three-phase mains to Niagara, we come across another three-phase to two-phase transformer before we finally arrive at the dynamos in the power house at the Falls. This is, of course, an extreme case of a combined system. At Croydon there is an interesting example of how the storage properties of accumulators can be utilised at an alternating current station. A synchronous alternating current motor drives a dynamo during the evening, which charges a battery of accumulators. From midnight and during the time of light load the reverse action takes place, the accumulators driving the dynamo as a motor, and the synchronous motor acting as an ordinary alternating current dynamo supplying the light load. Hence the necessity of keeping an engine running on a light, and therefore uneconomical, load during the greater part of the day and night is avoided.

FREE LIBRARY AND TECHNICAL SCHOOL, COLNE.—On the 10th inst. the ceremony of laying the memorial-stone of the new public library, assembly hall, and technical school for the borough of Colne took place. The building, with its appointments, is expected to cost about 10,000*l*. The engineers for the works are Messrs. Saunders & Taylor, of Manchester. The architects are Messrs. Woodhouse & Willoughby, of the same city.

OBITUARY.

MR. J. WOODLEY.—We have to record the death, on the 15th inst., at Stratford (London), of Mr. J. Woodley, clerk of works, in his eightieth year. Mr. Woodley was for nearly thirty years in the service of the late Mr. E. C. Robins, during which time he superintended works of some magnitude, including Congregational colleges at Milton, Norwood, Caterham, &c. Previous to this he was general foreman in the firms of the late George Myers, John Kirk, and J. T. Chapel. He took an active part in the formation of the Clerk of Works' Association, and was considered by its members an authority upon brickwork. Owing to failing health he had to retire from his duties six years ago.

GENERAL BUILDING NEWS.

NEW CHURCH, WESTON-SUPER-MARE.—A new Wesleyan church was opened on Thursday, September 13, at Weston-super-Mare. There is accommodation on ground and gallery floors for about 900 persons. The style of architecture is Decorated Gothic, with tracery windows of Bath stone filled with leaded lights. At the north-west corner is placed a tower, with spire rising to a height of 120 ft. The building consists of nave, transepts, chancel, minister's vestry, and organ chamber on the ground floor, and a gallery on three sides of the church. The interior woodwork of pews, gallery, and roof, which is waggon-headed, is pitch-pine varnished. The total cost of the building was about 5,600*l*. The architect is Mr. W. J. Morley, of Bradford, and the whole of the building works have been carried out by Mr. W. Gibson, of Exeter. The heating has been done by Messrs. Weech & Sons, of Bristol, and the stained glass by Mr. W. Lazenby, of Bradford.

WESLEYAN CHURCH, CROYDON.—A new Wesleyan church in the London-road, Croydon, was opened recently. The building will accommodate 1,000 persons. Messrs. Gordon, Lowther, & Gunton were the architects, and Mr. E. J. Saunders, of Croydon, was the builder.

UNITED METHODIST CHURCH, REDDITCH.—A church and Sunday school for the United Methodists have just been erected in Mount Pleasant, Redditch, at a cost of 2,700*l*. The church is of red brick with Bath stone dressings, and accommodates 500 persons. The building is lit by electricity. Mr. H. R. Lloyd, of Birmingham, was the architect, and Messrs. C. G. Huins & Sons, of Redditch, the contractors.

PRESBYTERIAN CHURCH, REDLAND, BRISTOL.—A Presbyterian church is to be erected on a site adjoining Cranbrook-road, Redland. The building will be of red Pennant stone with Bath stone dressings. Messrs. P. Munro & Son, of Bristol, are the architects.

PRIMITIVE METHODIST CHAPEL, KEMBLE, WILTSHIRE.—Memorial stones were laid recently of a Primitive Methodist chapel at Kemble, near Cirencester. Mr. Raymond Compton, of Ewen, is the builder, and Messrs. G. F. & E. Newcombe, of Cirencester, are the architects.

FREE CHURCH, BANK, AYRSHIRE.—A Free church has been built at Bank from plans by Mr. Hunter, of Ayr.

WESLEYAN CHURCH, NORTH BIDDICK, GATESHEAD.—A new Wesleyan Methodist Church at North Biddick, Gateshead, was opened on the 15th inst. It provides seating accommodation for 280 persons, is a brick-built structure in the Early English style, faced with Blyths red bricks, and having stone dressings throughout. At the north-west corner there is an octagonal tower with a turret on the top, covered with green Westmoreland slates. The interior shows an open timbered roof, with substantial principal trusses, and purlins of pitchpine, the ceiling being plastered in panels between. The floor is constructed with a fall of 18 in. towards the rostrum; and seating of framed pitch-pine is arranged on each side of a central aisle. At the rear of the church there is a schoolroom, to accommodate about 200 persons, as well as a vestry and conveniences. The total cost of the buildings amounts to about 2,000*l*. The contract has been carried out by Mr. Thos. Robinson, builder, Washington, from designs by Messrs. J. G. & R. G. Cowe, architects, Chester-le-street.

SANATORIUM FOR CONSUMPTIVES, DUNDEE.—A sanatorium for consumptives is to be erected on a site on Greenford Muir, at the foot of Auchterhouse Hill, Dundee. The plans have been prepared by Mr. William Alexander, Dundee's City Architect. The cost will be about 15,000*l*.

REBUILDING PUBLIC HALL, EAST GRINSTEAD.—The old public hall, East Grinstead, has been purchased for business premises, and altered and partially rebuilt, with a new frontage, for that purpose. Local red bricks have been used for facings, and Crowborough and Hackenden stone for dressings, cornice, &c. The external woodwork is of oak. The paving to the entrance is in two shades of green Irish marble. The whole of the ground-floor area is used for setting out furniture in suites, storage being provided in the basement. The galleries forming the first floor are also used for furniture. The walls are panelled up to the gallery ceiling, and painted above; the ceiling is formed with asbestos canvas in panels, woodwork and

ceilings are painted white, and walls a very light green. A feature in the front is the sign, designed and made in the studio of Messrs. Ramsden & Carr, of London; the signboard is of dark oxydised beaten brass on a frame of wrought iron, the letters being of aluminium; with four panels of enamel work varying in tone from green to silver blue. The supporting bracket and ornaments are in dark solid hammered brass. The gates at the entrance and the lettering over the shop front were carried out by the same firm. Mr. John Laxford, of Forest-row, was the builder, and Mr. Stainton (London) carried out the heating arrangements. The architect is Mr. F. Turner Powell, of London.

EXTENSION OF ABERDEEN ART GALLERY.—In order to give room for the Kepplestone Art Collection presented to the institution by the late Mr. A. Macdonald, granite merchant, Aberdeen, the Art Gallery, Schoolhill, is to be extended westwards so as to permit of the whole collection being placed in the enlarged upper west gallery. Mr. A. Marshall Mackenzie, Aberdeen, has been appointed architect. There will be an arched gateway under the extended gallery, and the total cost will be 2,000*l*.

VILLAGE HALL, KNIGHTON.—A new village hall has recently been opened at this place. It is built of brick, with stone dressings, is about 50 ft. by 26 ft., and will seat 250 persons. At one end is a raised stage, on the sides of which are a kitchen and a committee-room, both being easy of access from the stage or main hall, and in cases of emergency both rooms can be utilised for extra exits. The hall is heated by means of a hot-water apparatus, with four radiators. The architect is Mr. G. A. Craig, of Market Drayton, and the builder Mr. Joseph Ellams, of Silverdale. The furniture of the hall and stage fittings were made and fixed by Messrs. Geo. Fleet & Sons, of Stoke-on-Trent.

NEW MISSION HALL, BINGLEY, YORKS.—On Saturday, the 8th inst., a new mission-room was opened in the Dubb, Bingley. The building is of stone, and is intended to furnish accommodation for about 200 persons. The architect is Mr. H. Foulds, of Bingley.

PRIMITIVE METHODIST CHURCH AND SCHOOLS, HARROGATE.—This church, which was opened on Tuesday, September 18, consists of nave, transepts, and organ recess, with vestries attached, and is built in the Decorated style of Gothic architecture, with a tower and spire at the corner, rising to a height of 100 ft. Accommodation is provided on the ground floor and end gallery for about 550 persons. The roof is an open one of pitch-pine. The pews and other woodwork are of pitch-pine. Adjoining the church is a schoolroom, 47 ft. by 29 ft., with an end gallery, a lecture-room, 20 ft. by 20 ft., and seven classrooms. A caretaker's house is also attached to the buildings. The architect is Mr. W. J. Morley, of Harrogate and Bradford. The various contractors are:—Mason, Mr. H. Abbott; joiner, Mr. J. W. Rudd; plasterer, Mr. T. Laycock; slater, Mr. J. S. Shepherd—all of Harrogate; plumber, Mr. J. Lindley, Leeds; painters, Messrs. Varley & Roebuck, of Thornton. The leaded lights have been executed by Mr. W. Lazenby, of Bradford, and the heating has been carried out by Messrs. England, Robinson, & Co., of Harrogate.

TECHNICAL SCHOOL, BLAYDON, DURHAM.—A technical school in Shibdon-road, Blaydon, was opened on the 12th inst. The building is of red bricks with stone dressings, and has three stories. The original plans were drawn by the late Mr. T. Nicholson, and Mr. E. Bowman, but the work has been completed by the latter gentleman, Messrs. Davidson & Bolem, of Blaydon and Birtley, having been the contractors. The ground floor has been fitted out as offices for the use of the Urban District Council. The cost has been about 4,000*l*.

HOME FOR IMBECILE CHILDREN, WOODILEE ASYLUM, DUMBARTONSHIRE.—On the 13th inst. the home for imbecile children at Woodilee Asylum, which has been erected by the Glasgow District Lunacy Board, was opened. The building is of freestone, and is detached from the main asylum building. It consists of three stories; the ground flat consists of store accommodation for the asylum. The first floor contains a hall and corridor, a dining hall, day rooms, play room, lavatory accommodation, and a small hospital for six patients. The second floor contains dormitories, lavatories, and nurses' rooms. There is accommodation for thirty-five children. Mr. R. A. Bryden, of Glasgow, is the architect.

CHURCH INSTITUTE, &C., WEST HARTLEPOOL.—A building comprising a Sunday school, a parish hall and a church institute has been erected at West Hartlepool. Mr. J. H. Morton, of South Shields, was the architect.

NEW NAVE, CHRIST CHURCH, STONE, STAFFORDSHIRE.—On the 13th inst. the new nave of Christ Church, Stone, was dedicated. The nave was designed by Mr. C. Lynam, of Stoke-on-Trent. Mr. T. R. Yoxall, of Stoke-on-Trent, was the contractor.

ST. PAUL'S FREE CHURCH, PERTH.—This building is being erected on the site occupied by the old church, with a slight extension of frontage towards the north, and is designed in the Early Decorated style. In the front elevation, the principal feature is the end gable, with two four-light windows with cusped and panelled heads in the lower stage, and a large five-light window with rich traceried head and deeply moulded jambs lighting the gallery. The gable flanks are finished with panelling, and the apex has an arcading of cusped panels with a central niche, over which a floriated cross forms the terminal feature. To the left of the main gable is a projecting stone porch, with wide moulded archway forming the principal entrance, and to the right another doorway serves as exit from the gallery. The ladies'-room and session-room form a two-story block to the left of the main entrance. The side elevations are simply treated with two tiers of triplet windows, the upper ones having trefoil cusped heads under an arch. Internally the church is divided into nave and side aisles by moulded columns and arches of wide span. The nave ceiling is semi-octagonal in form, divided into bays by arched timber ribs. Over the side aisles the main couples are also shown and filled with ornamental timber cusping. The church is planned with side and end galleries, but the side galleries are narrow, and recessed at the columns, which are thus shown unbroken from the floor to the ceiling arches. The total number of sittings provided will be 800, and the estimated cost is within 4,000*l*. The architect is Mr. John B. Wilson, of Glasgow, and the works are being carried out by the following contractors:—Mason, Mr. A. Beveridge; wright, Mr. William M'Quibban; slater, Mr. D. M'Lauchlan; plumber, Mr. James M'Leish; plasterer, Mr. John Peebles; glazier, Mr. C. Alexander—all of Perth. Mr. Thomas L. Kay is clerk of works.

BUSINESS PREMISES, NEWTON, N.B.—New stores buildings, erected by the Newton Co-operative Society, Limited, were opened on the 8th inst. The buildings consist of two stories, the lower being intended for shops and the upper for dwelling purposes. The cost is estimated at 2,500*l*. Messrs. Wright & Adam are the builders, and the architect is Mr. W. Ferguson of Glasgow and Cambuslang.

MUNICIPAL DEPÔT, CAMBERWELL.—The foundation-stone was laid recently of a municipal depôt for Camberwell, at Grove-vale, East Dulwich. The site is on the north side of Grove-vale, and is about 1⅝ acres in extent. The buildings are being erected in blocks. One block will contain stabling for eighty-eight horses, with a veterinary surgeon's room. Other blocks will contain the smith's, farrier's, and wheelwright's shops, while there will be sheds for some eighty-four carts. There will be a steam-roller shed and a yard for storing materials. On the south side of the site a committee-room and general offices are to be erected. The building is being erected of stock bricks with blue Staffordshire brick plinths, but some cottages, which will be erected at the main entrance to accommodate the superintendent and horse-keepers, will be faced with red Fareham bricks, with stone dressings. The plans were prepared by Mr. W. Oxtoby, the Surveyor to the Vestry. Mr. H. L. Holloway, of Deptford, is the contractor, and the estimated cost is over 28,000*l*. Mr. H. Castle is the clerk of works.

MISSION CHURCH, GUARDBRIDGE, FIFE.—A church for the Scottish Episcopal Mission is to be erected in Guardbridge. Mr. C. F. Anderson, St. Andrews, is the architect, and the contractors for the work are—mason, Mr. William Ness, St. Andrews; joiner, Mr. Andrew Thom, Strathkinness; plumber, Mr. J. M. Morris, St. Andrews; plasterer, Mr. A. R. M'Pherson, St. Andrews; and slater work, Mr. William Greig, St. Andrews.

REOPENING OF METROPOLITAN TABERNACLE, NEWINGTON BUTTS.—The Metropolitan Tabernacle was opened on the 19th inst. after reconstruction. The front portico and main walls were all that remained after the fire in 1898, and these have been worked into the new building. The chief alteration in plan is in the length of the auditorium, which has been decreased about 13 ft., the space thus obtained being added to the vestry building in the rear. The new galleries, of which there are two, are constructed on plate steel girders, and each gallery has four stone staircases. The roof is constructed of steel-framed ribs braced with steel lattice girders, and is covered with slates. The seating accommodation is less than in the old building, being for just over 2,700 persons. The building is lit by electricity and heated by hot-water radiators. Messrs. Higgs & Hill were the builders, and Messrs. Searle & Hayes the architects. The cost of re-building was about 40,000*l*.

LIBRARY, WESTON-SUPER-MARE.—With reference to our observations (p. 238 *ante*) on the erection of this building, we are requested to state that the pitch-pine and birchwood block flooring in connexion with the building was laid by Mr. Roger L. Lowe, of Farnworth, near Bolton.

SANITARY AND ENGINEERING NEWS.

DUBLIN MAIN DRAINAGE.—The foundation-stone of the new outfall works for the Dublin main drainage was laid a short time since. The scheme was originally planned so as to include the districts of Clontarf, Drumcondra, Grangegorman, and Kilmainham, which have since under the Boundaries Act been included in the city, so that no alteration was needed in the scheme owing to this new legislation. The site for the outfall works as originally planned in 1801 by Mr. G. Chatterton, M. Inst.C.E., was the Whitebank, a narrow sand-dune, lying close to the Poolbeg Wall, and about half-way between the Lighthouse and the Pigeon-house Fort. At this time the War Department was in possession of the latter, and utilised it chiefly as a depot, and in the summer as quarters for recruits. The total extent of the property acquired by the Corporation covers about sixty acres. The buildings themselves are very extensive. The largest block, lately used as the officers' quarters, was the old Pigeon-house or Pigeon-house Hotel, built in the year 1790, for the accommodation of passengers between Ireland and England. As soon as the Corporation became possessed of the property, the scheme was slightly modified to suit the present site, viz., the existing harbour of the fort. This contains about ten acres, of which some eight are to be reclaimed by a sea-wall, and two at the east end to be retained for the berthage of vessels used in connexion with the scheme. On the area reclaimed eighteen precipitation tanks are to be constructed, with various culverts, channels, and tanks in connexion therewith. Almost all the work is below the level of high water mark of ordinary spring tides, and a very large proportion of it is below low water mark of same, and consequently the operations are of no light character. Messrs. S. Pearson & Son have undertaken the contract for 94,000*l*. The walls, tanks, and other permanent works are to be constructed entirely of Portland cement concrete, and some 50,000 cubic yards of this material will be required. The iron work portion of the contract, comprising the pumping machinery, and valves of special designs, has been placed by Messrs. Pearson & Son in the hands of Messrs. Glenfield & Kennedy, who have for many years carried out similar work for the Corporation.

THEATRE ROYAL, MANCHESTER.—This theatre has recently been warmed and ventilated by the Sutcliffe Ventilating and Drying Company, on the Plenum system. In designing this warming and ventilating installation, the following points were kept in view:—1. To make use of every then existing air shaft that could in any way be adapted for the purpose. 2. To cut the building about as little as possible. 3. To create a slight Plenum or pressure inside the theatre so that the air had a tendency to pass through the crevices of doors, &c., from the inside of the building to the outside, instead of from the outside to the inside, which would have been the case if an "extracting" instead of a "Plenum" system had been adopted. 4. To leave no room for complaint by the fire insurance authorities. In regard to the first point the firm only required two additional ducts, and they run only from pit floor to pit ceiling, and then across the back wall of the circle, where they join two old ducts. The new boiler occupies the position of the old warm air furnace, and the work here has mainly been the building up and making good of old passages.

Method of Warming.—A sectional steam boiler with fire-grate, 36 in. by 24 in., is fixed in the basement behind the pit bar. This boiler works at 1-lb. to 5-lb. pressure, and will effectually heat 1,200 square feet of piping or other radiating surface. It is fitted with steam gauge, safety valve, damper, and automatic boiler feeder, and is covered with asbestos. There are two main steam pipes, one of them running under the floor at the back of the pit, whilst the other is taken down the centre of the pit to the orchestra. From these main steam arteries, branches are taken to radiators under the pit floor and to radiators in all the entrances. Each one can be disconnected in a moment from the main steam supply pipe, and one, two, or any number up to the full fourteen may be used, thus bringing the temperature under absolute control. There are no radiators, pipes, or valves in the theatre proper, with the exception of two small pipes in the orchestra, and these with their controlling valve are in charge of the conductor.

Method of Ventilating.—The ventilation is combined with the warming. That is to say, a 36-in. Sutcliffe fan driven by an electric motor forces fresh air over the radiators previously described, and this fresh air is warmed to any desired temperature before it enters the theatre. The air is drawn from Peter-street, but before it is warmed it has to pass through a filter screen of coke which effectually removes the dust and dirt. The cubical contents of the theatre are in round figures 180,000 ft., and as the fan at a moderate speed moves 10,000 cubic feet of air per minute, it moves sufficient air to change the whole of the air in the theatre every eighteen minutes. If the fan is driven at its full speed, say for summer ventilation, it will move 15,000 cubic feet of air per minute, sufficient to change the air in the theatre every twelve minutes.

WATER SUPPLY, STEETON, NEAR KEIGHLEY.—The Keighley Rural District Council have decided to apply to the Local Government Board for powers to borrow money to carry out the scheme of their Engineer, Mr. R. B. Broster, for providing a new water supply for Steeton.

WATER SUPPLY, MERTHYR.—Arrangements are being made by the Merthyr Urban District Council for the completion of a scheme of water supply from the Upper Neuad reservoir to Dowlais and Gelligaer. Mr. Deacon has been appointed engineer.

SEWAGE SCHEME, HEDDON-ON-THE-WALL.—The Castle Ward Rural District Council have approved of and accepted the scheme of sewage disposal for Heddon-on-the-Wall, prepared by Mr. Harry W. Taylor, of Newcastle and Birmingham, and application to the Local Government Board to borrow 1,250*l*. for carrying it out will be made at once.

The sewage will be discharged into the tidal river Tyne. The Council have also given Mr. Taylor instructions to prepare a scheme of sewerage and sewage disposal for Dinnington Colliery.

FOOT BRIDGE, AYR.—A new foot bridge over the river Ayr, on the site of the Ducat stream, was opened on the 12th inst. The bridge is of steel and is 6 ft. wide. It has five arches, each of 60 ft. span, resting on piers of Ballochmyle stone. The footway is paved with tar macadam, and the bridge is lit by electricity. The cost was about 2,500*l.* Messrs. John & H. V. Eaglesham, of Ayr, were the engineers, and Mr. Wm. Clarke, of Ayr, was the contractor.

ELECTRIC LIGHTING NEWS.

ELECTRICITY WORKS, GLASGOW.—The inauguration of the new electricity works at Port-Dundas and Pollokshaws-road, Glasgow, was celebrated on the 13th inst. The Port-Dundas works will supply current for the north side of the river. The area of the ground which the Corporation has purchased is about 4½ acres. The buildings were designed by Mr. Andrew Myles, C.E., and erected by Messrs. John Porter & Sons. Only the central portion has been built as yet. From the central entrance under the tower there is ingress to the two accumulator rooms, each of which contains 167 accumulator cells supplied by the Tudor Accumulator Company, which are mounted on steel stands, with lead covers, supported on insulators. The floor is of rough asphalt, so as to be as far as possible acid proof. These accumulators are capable of supplying approximately 615 lamps of 16 candle-power for seven hours, or a greater number of lamps for a corresponding shorter time. The regulating switch, made by Mr. James White, of Glasgow, is controlled from the engine-room, so that the number of cells connected to the mains can be varied as necessity arises. From these rooms access is gained through a lobby to the staff rooms, which are fitted up with lavatory accommodation and bath-room. One of these rooms is intended for the use of the electrical staff, and the other for the enginemen. The switchboard gallery runs the whole length of the engine room, and from it can be obtained a complete view of the engine room plant, and also of the switching and recording arrangements for the distribution of electric energy to the various parts of the city. The equipment of the engine room is, however, not yet completed. The new works for the south side of the city—to be known as the St. Andrew's Cross Electricity Works—are situated in Pollokshaws-road, in close proximity to the junction of Eglinton-street and Maxwell-road. They occupy about two acres of ground, and the buildings have been designed by Mr. Andrew Myles, C.E. Built by Messrs. John Green & Co., they are constructed mostly of red brick, and are nearly approaching completion. The engine and boiler rooms will accommodate 15,000 horse-power of boilers, engines, and dynamos.

ELECTRICITY WORKS, EAST HAM.—The foundation stone was laid recently of the electricity works which the East Ham Council are erecting on a site facing Nelson-street, off the Barking-road. The building will cost 20,000*l.*, and is being erected by the Council's own workmen. The works will supply electricity for lighting and for working various tramways. Messrs. W. H. Savage and A. H. Campbell are the engineers, the electrical engineer being Mr. W. C. Ullmann.

FOREIGN.

FRANCE.—The monument raised by subscription to the memory of Chopin is to be inaugurated shortly in the Luxembourg Gardens, not far from the Rue de Fleurus. This is the monument originally intended for the Parc Monceau, of which M. Dubois is the sculptor. For the bust he has depended chiefly on a portrait by Delacroix. The bust will be placed on a stele decorated with a female figure symbolising the Muse of Chopin.——The bas-reliefs and friezes in ceramic ware, modelled by M. Gustav Michel, which decorated the Palais des Beaux-Arts and Des Arts Libéraux in the 1889 Exhibition, are to be placed in the Square Monge, under the direction of M. Formigé as Architecte des Promenades.——M. Pascal, architect, and MM. Thomas and Germain, sculptors, are at work on the monument to Charles Garnier which is to be erected in the Rue Auber, in front of the Opera House. The monument, which is 8 mètres high, will be terminated by the bust of Garnier by Carpeaux. Two consoles attached to the pedestal will carry figures symbolising Study and Fame. The figures and ornaments, in gilt bronze, will be relieved against a pedestal of red granite, which will bear, instead of the usual inscriptions, the plan of the Opera House engraved on a bronze tablet.——M. Scellier de Gisors has in hand important operations of repair and restoration in the Luxembourg, where the Salle des Fêtes and the "Galerie des Bustes" are to be restored to their original condition.——At the Palais Royal the foundations have been commenced for the pedestal to the statue of Balzac by Falguière, the model of which had been completed before the death of the sculptor.——A monument commemorative of the battle of Waterloo is to be erected on a site acquired by M. Osiris. The monument, designed by M. Gérôme, will consist of a column surmounted by an eagle bearing in its talons the French standard, and endeavouring to spread its wings which have been maimed by shot.——M. Redon, the architect to the Louvre, is occupied in arranging, in the former "Salles des Dessin," the best examples of furniture and tapestries from the "Garde-Meuble National," as well as a certain number of rare objects scattered about the museum. The 40,000 drawings by old masters will be rearranged in the rooms on the first and second floors surrounding the Cour du Louvre.—It is announced that the Hôtel de Luynes, in the Boulevard St. Germain, is to be pulled down, having been compulsorily purchased for a street improvement. The fine paintings by De Troy, in the building, will probably go to the Carnavalet Museum.——A new church of St. Joseph is to be built at Nancy.——The death is announced, at the age of seventy-five, of the painter Charles Monginot. He was a pupil of Couture, and received medals in the Salons of 1854 and 1869, as well as at the 1889 exhibition. His special talent lay in pictures of flowers, fruit, and still life. The Luxembourg and the museums of Troyes, Chartres, and Pau possess examples of the work of this conscientious artist, whose pictures were at one time in great request.

INDIA.—The Secretary of State for India has sanctioned the construction of the Pamban branch of the South Indian Railway.——The East Indian Railway authorities contemplate remodelling Howrah station to meet increased requirements of traffic, and it is probable that the stations at Hooghly and Kalka will also be rebuilt.——Orders are about to be issued by the Government assigning about ten lakhs of rupees for the construction of the Barun-Daltonganj section of the East Indian Railway. Mr. Cockshott is the engineer in charge.——Observatory buildings are about to be constructed on the Dodabetta Peak, in the Nilgiris district; the Chief Engineer of the Public Works Department suggests that perforated zinc ventilators, closed with batten doors, are more suitable for such buildings than glazed ventilators which were proposed to be used.——The general results of the examination of the Bombay water supply show that the advent of the rains has improved the Vehar and Tansa waters, and no pathogenic bacteria have been found in them; on the other hand, the Tulsi water contains a large amount of free ammonia and nitrites, and though no pathogenic bacteria have been found, the water in its present state is not considered wholesome. The health of Bombay is still very bad.

UNITED STATES.—The Secretary of the Treasury has divided his invitations to submit designs for the Government building at Indianapolis equally between local architects and the profession in America at large—a method which seems to have given general satisfaction.——The death is announced of a well-known American sculptor, Mr. Carl Rohl-Smith. His principal works were the statue of Franklin, in Lincoln Park, Chicago; a figure of the "Defender of the Alamo," for the Alamo monument at Austin, Texas; and a statue of Judge Reid, of the Kentucky Superior Court.——The Art Students' League of New York is endeavouring to make the instruction it gives in sculpture of more immediate and practical value to the student, and the members of the National Sculpture Society are encouraging the movement. The students are to be more particularly directed towards the consideration of architectural and industrial modelling, a field which is now mainly cultivated by German and Italian artisans.

MISCELLANEOUS.

PROFESSIONAL AND BUSINESS ANNOUNCEMENTS.—Messrs. Ransome & Co., Limited, engineers and ironfounders, of Newark-on-Trent and London, have removed their works from London to Newark-on-Trent. The firm is temporarily retaining its Chelsea works as its London office and showrooms.

INSTITUTE OF SANITARY ENGINEERS.—At a meeting of the Election Committee, held on the 12th inst., the following gentlemen were elected members:—A. Hale, Simla, India; F. D. Stuart, Lincoln; A. Styles, New Cross; associate, F. E. Wintle, Berealstone.

LONDON COUNTY COUNCIL SCHOOL OF ARTS AND CRAFTS.—The London County Council Central School will re-open for the fifth session on Monday next, September 24. The classes, which are all held in the evening, at nominal fees, are intended for the benefit of workers in the artistic crafts, and comprise architecture, silversmiths' work, chasing and engraving, enamelling, stained glass, book-binding, illumination, embroidery, &c. New classes are being formed in cabinet work and inlay, also repairing of books and MSS. The school has gained the distinction of a Grand Prix at the Paris Exhibition. Prospectus and all information can be obtained of the curator, 1316, Regent-street, W.; or of the Secretary, Technical Education Board, 116, St. Martin's-lane, W.C.

ROMAN VILLA, BRISLINGTON, NEAR BRISTOL.—These Roman remains are situated just within the boundary of the enlarged city of Bristol, the field in which the work of investigation has been carried on being the extreme south-east corner of the municipal area. In the first instance some members of the Clifton Antiquarian Club, acting as a small committee, took the work in hand, and subsequently the Bristol Museum authorities undertook the responsibility of carrying through the exploration. The directors of the company to whom the land belongs generously gave the Museum Committee permission to carry on a complete investigation of the site, and also placed at their disposal for exhibition in the Museum whatever relics might be found. It became necessary to proceed at once with the removal of the remains of the pavement in the roadway, and although nothing could be more unfavourable than the state of the ground and of the weather at the time, this was successfully accomplished, and there are now at the Museum a large number of square blocks of mosaic which have been bedded on cement and can be put together at any time. The pattern of this floor is geometrical, of a somewhat plain character, the different ornaments being repeated at intervals throughout. Under more favourable circumstances the removal of the remains of a second pavement, adjoining the first, was effected. In this case the pattern is much more elaborate and striking than in the other, especially as regards the centre, which is formed of a large and elegantly-designed urn, with ornamental border. At present there is no space in the Museum for the proper display of these valuable relics. There can be no doubt that other pavements at one time existed, as in various positions small patches of mosaic flooring were found, also quantities of loose tesseræ, and portions of the beds of concrete on which the floors at one time rested, but they were entirely destroyed, either when the villa was burned down or at some other time. The tracing of the foundation walls has revealed the arrangement of the different apartments, although in consequence of a road which was under construction cutting the villa in two, a complete view of the ground-plan could not be obtained. A very noticeable feature of the exterior is the existence, *in situ*, of a large part of the solid watercourse for conducting the rain-water, which followed the line of the frontage, and which shows the marks of considerable wear and tear in the passing to and fro of the inhabitants. The position of the villa facing the south-west was, no doubt, purposely chosen, as the spot selected must have been then, as indeed it is now, an exposed one. In two of the chambers in the rear, the hypocausts when uncovered were found to be in an unusual state of preservation. Many of the small pillars on which the floors rested, and around which the hot air circulated, remained in their original positions, as did also part of the concrete flooring itself. The massively-constructed flue which connected these two apartments also remained intact. In regard to miscellaneous objects discovered, the upper stone of a quern of unusual type and in perfect condition is notable; also portions of mortaria large and small. Other fragments of pottery, plain and ornamental, belong to vessels of all sizes, and comprise specimens in great variety of the Upchurch, Salopian, and Castor kinds. There were no examples of true Samian. The specimens of glass in various colours are also numerous, many of them being beautifully iridescent. Some small objects such as a fibula and other bronze articles, glass beads, and several things of the kind have also been discovered. The iron work found consists chiefly of articles used in the construction of the villa, such as the nails for fastening the roof tiles. There are also various tools, and the remains of an iron-bound box. Perfect specimens of the roofing tiles are preserved. The bones and teeth of various animals are present. Only a few coins have been found, but several of them are in fine preservation. They range from Victorinus, A.D. 265-267, to Constantius, A.D. 350-361.—*Bristol Times and Mirror.*

LABOUR IN THE BUILDING TRADES DURING AUGUST.—According to the *Labour Gazette*, employment in the building trades remained good during August. The percentage of unemployed union members among carpenters and plumbers at the end of the month was 1·8, the same percentage as in July. The percentage for August last year was 1·2. Two disputes commenced during the month; one at Dundee, where over 200 carpenters and joiners "struck work" because of a proposed reduction in wages, and one at Greenock, where a few carpenters and joiners came out on strike because of a refusal of their employer to allow machines in shops to be worked by joiners only. The Dundee dispute has been settled by the men resuming work at the old rates of wages. At Greenock the machines are now worked by joiners pending a decision by the employers' and workmen's associations.

PARIS EXHIBITION AWARDS.—To the list of English firms which obtained awards at the Paris Exhibition (given in our issue of the 1st inst.) we have to add the following: The Atmospheric Steam Heating Company, a Gold Medal in the American section under the heading of "Warren Webster & Co.," whose rights in Great Britain they hold; and Messrs. Arthur Lee & Bros., Silver Medal for marble tile pavement placed by them in the entrance hall of the British Royal Pavilion.

WINDOW, LANGTON-ON-SWALE CHURCH, NORTHALLERTON.—Stained glass has just been placed in the west window of this church. The design illus-

trates the Annunciation and the Nativity, the window consisting of two lights, with tracery above. Messrs. Powell Brothers, of Leeds, are the artists.

CAPITAL AND LABOUR.

DISPUTE AS TO FIXING TERRA-COTTA, BARROW.—After being locked-out for about a week, the bricklayers and stonemasons employed in Barrow agreed to submit the disputed matter to arbitration. The dispute is as to which of these branches of industry is entitled to set the terra-cotta facings at the new technical schools. The work was being done by the stonemasons, but to this the bricklayers objected.—*Yorkshire Post.*

LEGAL.

IMPORTANT BUILDING DISPUTE.

THE case of Gibb *v.* Steanes came before Mr. Justice Buckley, in the Vacation Court, on the 19th inst., on a motion by the plaintiff, a builder, for an injunction to restrain the defendant until the trial from interfering with a building which he was erecting.

Counsel, in support of the application, said that Mr. Steanes had a motion in the list for an injunction to restrain Mr. Gibb until the trial from so erecting his building as to interfere with the light and air coming to his (Mr. Steanes') building, and suggested that both motions should be taken together.

There being no opposition, his Lordship said he would take both motions together.

Counsel for Mr. Gibb stated that his client was erecting a house adjacent to some engineering works belonging to Mr. Steanes, and this gentleman alleged that one of the rooms in Mr. Gibb's building interfered with the light and air coming to his engineering shop, and on three separate occasions when Mr. Gibb had put the roof on his building Mr. Steanes had pulled it off. That being so, Mr. Gibb had no other course open to him but to apply for an *interim* order. Substantially the real question raised by the motion and cross-motion was whether Mr. Gibb was entitled to put the roof on his building or not. The learned Counsel said it was not a case which could be properly tried on motion, and suggested that both motions should stand till the trial and that the trial should be expedited.

After some discussion it was arranged that both motions should stand till the trial, Mr. Gibb undertaking not to proceed further with his building in the meantime, and Mr. Steanes undertaking not to interfere further with Mr. Gibb's building. Liberty to either party to apply to expedite the trial as soon as they were ready, and pleadings to be delivered in the Long Vacation.

RECENT PATENTS:

ABSTRACTS OF PATENTED INVENTIONS.

10,330.—RADIATORS FOR WARMING AND COOLING ROOMS: *R. Crittall.*—The sections of the radiator consist of metal tubes joined together, one of them is perforated, has screw-threaded ends, and is inserted through the section-bosses, and tightened with nuts. The sections are closed with caps made of stamped metal, the ends of which are turned or beaded, and are strengthened with internal abutment pieces or stays.

10,338.—A DRESSING FOR WOODEN PAVING-BLOCKS: *H. Dunlop.*—The dressing is composed of an admixture of 3 cwt. of resin and ½ cwt. of caustic soda, boiled and then cooled, and 1 cwt. of Portland cement, 2 cwt. of calcined clay, and 2 cwt. of screenings of basalt or other igneous rock. When the compound is set a coating is added of a hot mixture of 2 cwt. of bitumen, 1 cwt. of resin, 2½ gallons of boiled linseed oil, and 12 gallons of Stockholm tar, boiled to a liquid condition. Then are added sand, 2 cwt. of calcined clay, and 2 cwt. of basaltic screenings. When the second mixture has become cool it is rolled and sanded many times.

10,347.—A BALL AND FLOAT VALVE: *H. von Hosstrup.*—The motion upwards of the float lever's shorter arm is utilised for raising a diaphragm valve from above the end of the nozzle's extension; when the head of the spindle has been lifted from its seating upon a metal disc water escapes from within the cap through an extended tube beneath, whereupon the valve is raised by means of a looped piece. With the specification should be read No. 8,864 of 1899.

10,372.—A RACK-PULLEY FOR WINDOW BLINDS: *T. D. Green.*—The pulley is caused to run upon a pin that is set in turned-over lugs upon the upper end of the sliding plate, the edges of which are turned upwards, and has slots or stamped-up teeth. A turned-over bearing upon the gravity-catch (which is bent from sheet-metal) operates upon another pin, and also upon a weighted lower part, and a bent-up tooth or catch which wipes over the projections when the sliding-plate is pressed down. The latter pin bears in the turned-up side pieces of a fixing-bracket made out of a cross-shaped blank of sheet metal.

10,386.—PURIFICATION OF SEWAGE AND FOUL WATERS: *W. M. Ducat.*—An aerobic filter bed, after the kind specified in No. 654 of 1897, and provided with perforated walls and inclined discharging-culverts, is enclosed within double walls, and a roof, made of some non-conducting material, whose trusses carry an inner roof—the space between the two roofs being rendered as air-tight as it can be; pipes, culverts, and side-passages admit air to the filter-bed, the air becomes warm through its contact with the outflowing sewage, and is then carried away through shafts.

10,423.—LAVATORY FITTINGS: *J. F. Houston.*—A box-frame which, when not being used, can be turned upon trunnions into a vertical casing, holds the basin. When the basin is tilted the discharge passes from a container at the basin's back into a chamber formed within a fixed tubular trunnion, and so through a port into the waste-pipe. A port within the trunnion serves for the incoming water, which flows thence through a passage into the basin's front. The end sections of the joint turn together with the box-frame, and are affixed to it.

10,434.—AN APPLIANCE FOR USE IN DEEP BORING: *A. Raky.*—In order to provide an adjustable counterpoise for the weight of rotatory boring rods and tools, the inventor causes the rods, or their frame, to be carried by a rope that is wound upon a drum geared by means of a multiple-gearing to another drum, which, with the descent of the rods, winds up a balance weight by means of a rope that extends over guide pulleys to a third drum; the third drum is to be turned with worm-gearing when it is required to pay out the rope for lowering the weight again. In another form the rope is made an endless one, so that it needs not to be wound backwards and forwards with the weight's rise and fall, or the frame of the boring rods may be fitted with racks for driving a pulley over which the endless rope is passed; the second drum described above is joined with belting to a hand wheel, which will turn in either direction and so increase or lessen the pressure exerted by the counterpoise weight.

10,474.—KILNS FOR DRYING AND BURNING BRICKS, TILES, LIME, &C.: *W. Tarrant.*—The continuous kilns are arranged so that waste heat given out in cooling the charge in some of the chambers shall serve for drying green goods or material in other chambers. A double wall, set lengthwise, contains the main smoke and waste-heat flues; on its opposite sides are arranged two rows of transverse arched chambers which communicate with one another by means of openings made in their dividing walls, and similarly with the two flues, dampers being provided for closing the openings as may be desired; passages from the waste-heat flue are made so as to open into each of the chambers through the face of a bag or screen, which is placed across the entire chamber. As the burning proceeds, fuel having been poured in through holes in the roof, the flames and gases pass from one chamber to another and so to the smoke-flue, whilst heated air, passing from the chambers in which the charge is being cooled, finds its way to the waste-heat flue and thence to the chambers in which the fresh charge has been laid.

10,497.—AN ALARUM CLOCK: *F. Bruck.*—Under normal conditions a hooked detent upon a pivot holds back a contact-arm, which is pulled by a spring from its fellow contact. When, however, the alarum has run down, the detent is disengaged by means of a winding wing-nut, and the circuit of an electrical lamp is thereby rendered complete; a slide enables a tripping of the detent at any time.

10,503.—PLUG COCKS: *H. W. Joyce.*—A locking-tap, as specified in Nos. 21,352 of 1896 and 6,517 of 1898, has its flanged body fastened with an outside-screwed ring to its bush, or an inside-screwed ring is held with lugs inside the bush; a turning of the ring presses the valve's screwed flange against the bush's inner side.

10,509.—DRAWING COMPASSES: *J. von Pallich and F. Knaus.*—Adjustable holders and clamps that hold brushes with which circles and lines of various overlapping colours can be described are mounted upon a bar the limb of which slides into a socket in a leg of the compass, and an adjustable compass point is also attached to the bar; otherwise the bar can be fixed at a right angle to the handle to enable the brushes to slide to any part of it, and overlapping circles may be described with two compass points.

10,510.—A FIRE ALARM: *H. C. Baer.*—Smoke or gas which do not support combustion are used to start an electrical or other kind of alarm; a thermostat is heated by a gas flame that burns continuously and prevents contact of two points which will become closed upon extinction of the flame and completion of an electrical alarm's circuit; a perforated inner casing and an outer casing enclose the flame, whose combustion is maintained by air admitted in quantity just enough for that purpose, through regulated openings cut in the outer casing, the flame becomes extinguished and an alarm sounds upon the entry of smoke or non-combustible gases within the two casings. With this contrivance a mechanical alarm can be employed, or the thermostat may be joined to the valve of an automatical sprinkler, which it will open if the flame becomes extinguished.

10,518.—A TRAVELLING CRANE FOR USE IN WORKSHOPS: *F. W. Fannett-Walker.*—At the ends of the shop are placed vertical rams which operate pulleys for the ropes which move lengthwise along the shop the carriages and transverse girders that carry a crab; other vertical rams work the ropes which at the same time move the carriage of a lifting cylinder, the crab, and the monkey to one end whereof the lifting rope is secured; all those movements are effected by plain directly-acting rams, but in one other form of the mechanism worm gear upon the crane that is driven by either a rope or a square shaft worked by a separate engine is adopted for lifting purposes; a power shaft, controlled by a lever near the traversing levers, drives the rope.

10,531.—A COMBINED TOOL FOR MORTISING WOOD: *J. D. Wood.*—The tool consists of reciprocating chisels combined with an auger, to be driven by an ordinary brace or by machinery; as the auger is rotated with bevel gearing and a crank handle an inclined disc upon its axis moves the chisels up and down, whilst a screw and a hinged nut give the tool a slow feed downwards, the nut becomes disengaged when the tool is lifted up, a quick return motion being effected by means of a rack and pinion, a ring that lies upon the wood guides the lower ends of the chisels. The mechanism comprises an adjustable clamp which fixes the wood upon the frame, and there are pivots for turning the frame in order that the tool may be used angle-wise.

10,550.—A RECORDING WEIGHING MACHINE: *W. E. Hipkins.*—The inventor has devised an apparatus for recording weights to be attached to steel-yard weighing machines used with weigh-bridges, on platforms, and so on, the steel-yard having two notches graduated according to the English and metrical systems. An adjustable catch carried upon the main poise engages with the one or the other set of notches, underneath the steel-yard and the two subsidiary poises are printing figures that correspond with the two systems, and tickets that correspond with the figures are inserted into slots made in the main poise. Handles are provided for impressing the tickets. For machines of the smaller kind the printing figures can be set upon discs in the pillar, and be joined to the poises with a rack and pinion gearing.

10,599.—A BRICK-MOULDING MACHINE: *A. Adams, W. Neale, and L. Simpson.*—A pipe that slides through a cylinder's stuffing-box and is joined to the plunger or cross-head with a tubular junction, a bracket and a bent tube, supplies steam to the plungers—which are hollow—or to the other moving portions of the machine, and a steam supply pipe, having a stop-cock, communicates with the cylinder's lower end. Exhaust steam is caused to pass to the waste pipe by similar means. In some instances elbow or ball-and-socket joints may be fitted upon the pipes so as to meet the movements of the parts. Steam at a high pressure is employed, whilst the use of rubber tubing is discarded.

10,640.—AN APPLIANCE FOR VENTILATORS: *A. M. Baily and W. Caldwell.*—The appliance is adapted for opening and closing the "butterfly openers" of malting-kilns, and provides means for moving the two-hinged doors at one and the same time by joining them with links on to a sliding rod which is worked by a rope that passes around pulleys.

10,650.—A WORKMAN'S CLAMP: *W. Goebel and G. Gockel.*—The arm, which slides upon the clamp's stem, is fixed to the stem with a wedge so arranged that it shall force the arm into engagement with teeth upon the stem, a screw whose nut is split and which has a side-screw which will compensate for wear, imparts a final holding grip to the article which is to be clamped.

10,664.—METAL LATHING: *M. Hilton.*—The lathing is made out of perforated metal sheets or strips, such as the waste or scrap left from the making of chain links, washers, &c., which are to be secured with staples or T-headed nails on to joists, partition standards, and so on. The strips are described as being applicable for wall-ties or plates, also for the construction of fire-proof floors and other parts of buildings.

10,669.—FIRE-ALARMS AND HYDRANTS: *W. Foncs.*—The alarms and hydrants are intended for use upon lamp-posts for electrical and other lighting purposes, near the base of the lamp-post and in the ground are sunk the main and by-pass cocks of the hydrants; a hydrant for watering roads may have a tap fitted upon one of its nozzles.

MEETINGS.

FRIDAY, SEPTEMBER 21.

Sanitary Institute (Lectures for Sanitary Officers).—Mr. J. Castell-Evans, F.I.C., on "The Atmosphere: Pressure and Composition; Air, Combustion, and Respiration." 8 p.m.

Institute of Sanitary Engineers (Incorporated).—Examination in Practical Sanitary Science.

SATURDAY, SEPTEMBER 22.

Institute of Sanitary Engineers.—Examination in Practical Sanitary Science.

Northern Architectural Association.—Excursion meeting visits to County Hotel and Newcastle Breweries' new works, Haymarket, Newcastle. 3 p.m.

MONDAY, SEPTEMBER 24.

Sanitary Institute (Lectures for Sanitary Officers).—Mr. J. Castell-Evans, F.I.C., on "Ventilation, Warming, and Lighting." 8 p.m.

[*See also page 261.*

COMPETITIONS, CONTRACTS, AND PUBLIC APPOINTMENTS.

(For some Contracts, &c., still open, but not included in this List, see previous issues.)

COMPETITIONS.

Nature of Work.	By whom Advertised.	Premiums.	Designs to be delivered
*Working Class Dwellings	Lichfield Corporation	10*l.* 10*s.* and 5*l.* 5*s.*	Oct. 10
Branch Police Station and Library	Leeds Corporation	25*l.*; 15*l.*; 10*l.*	Nov. 20

CONTRACTS.

Nature of Work or Materials.	By whom Required.	Forms of Tender, &c., Supplied by	Tenders to be delivered
*Police Cottage at Thakeham	West Sussex County Council	County Surveyor, 31, Bedford-road, Horsham	Sept. 22
*Bridge	Sheffield Corporation	City Surveyor, Town Hall, Sheffield	Sept. 25
*Baths and Library	do.	do.	do.
*Road Making and Paving Works	Willesden District Council	O. Claude Robson, Public Offices, Kilburn	do.
*Broken Granite	Edmonton U.D.C.	Engineer, Town Hall, Edmonton	do.
*Portland Cement	do.	do.	do.
House, Buckie, N.B.	.....	Sutherland & Jamieson, Architects, Elgin	do.
House, &c., St. John's-avenue, Bridlington Quay	Mr. A. Jennison	J. Earnshaw, Architect, Wellington-road, Bridlington Quay	do.
Schools, Holland-street	Hull School Board	Botterill & Co., Architects, 23, Parliament-street, Hull	do.
Electric Lighting Plant	Walthamstow U.D.C.	J. Ewright, 47, Victoria-street, S.W.	do.
Making-up Meads-lane	Ilford U.D.C.	H. Shaw, Civil Engineer, 7, Cranbrook-road, Ilford	do.
Sewers, &c., Lancaster-road	Salford Corporation	L. C. Evans, Town Hall	do.
Sewerage Works, Goosemoor-lane	Erdington U.D.C.	H. H. Humphries, Engineer, Public Hall	do.
Road Works, Linacre-road, &c.	Litherland (Lancs.) U.D.C.	W. B. Garton, Surveyor, 25, Sefton-road, Litherland	Sept. 26
Flagging, &c., Several Streets	Birkenhead Corporation	C. Brownridge, Civil Engineer, Town Hall	do.
Schools, Tunstead	Bacup School Board	Smith & Cross, Architects, Rochdale	do.
*Alterations and Additions to Free Public Library	Chiswick U.D.C.	A. Ramsden, Surveyor, Sutton Court, Chiswick	do.
*Enlargement of Master's House at Workhouse	Kensington Guardians	Ernest Flint, Architect, 80, Coleman-street, E.C.	Sept. 27
Fencing Work, &c.	Moss Side (Lancs.) U.D.C.	H. B. Longley, Engineer, Council Offices	do.
*New Outfall Sewer, St. Peter's	Tunbridge Wells Corporation	Borough Engineer, Town Hall, Tunbridge Wells	Sept. 28
Chapel Buildings, Mandeville-street, Sheffield	Trustees of Darnall Wesleyan C.	W. T. Campsall, Architect, 19, Figtree-lane, Sheffield	do.
Pair Villas, South Parade, Pudsey, Yorks.	.....	Farrar & Woodhouse, Architects, 38, The Grove, Ilkley	do.
Additions to Schools	Annan (N.B.) School Board	H. E. Clifford, Architect, 178, Vincent-street, Glasgow	do.
Additions to Schools	Oxspring (Yorks.) School Board	Senior & Clegg, Architects, 16, Regent-street, Barnsley	do.
Quartzite (400 tons)	Walmer (Kent) U.D.C.	R. A. Wilson, Surveyor, Council Offices	Sept. 29
Vicarage, Wales, near Sheffield	.....	Boreham & Morton, Surveyor, 24, John-street, Sunderland	do.
Culverts, Shooters' Brook, &c.	Manchester Corporation	Borough Surveyor, Town Hall	do.
Additions to Hotel, Falcarragh, co. Donegal	Miss M. M'Ginley	D. Conroy, Architect, 2, Bishop-street, Londonderry	do.
Alterations to Schools, East End	Redruth School Board	S. Hill, Architect, Green-lane, Redruth	do.
Twenty Cottages, Pantygraigwen, Pontypridd	Great Western Colliery Co., Ltd.	A. O. Evans, Architect, Pontypridd	do.
Pavilion and Shelter, Lichfield-street	Walsall Corporation	H. E. Lavender, Architect, Bridge-street, Walsall	Sept. 30
Rebuilding Store Premises	Alcester Co-op. Indus. Soc. Ltd.	J. W. Adams, Architect, Hay Mills, Birmingham	Oct. 1
Abattoirs	Bury (Lancs.) Corporation	A. Neill, Architect, 18, Cookridge-street, Leeds	do.
Sewers, Aughton, Lancs.	West Lancs. R.D.C.	C. Law-Green, Civil Engineer, 50, Hampton-road, Southport	do.
Additions to Ashfield House, Liversedge	Mr. C. W. Clarkson	Marriott & Co., Civil Engineers, West Park-street, Dewsbury	do.
*Forty-eight Cottages, Belvedere, &c.	Erith U.D.C.	Council's Surveyor, High-street, Erith	do.
*Terrace of Houses, Chingford	.....	W. J. Chambeas, Architect, Savoy House, W.C.	do.
Additions to Orchard House, Workington	Mr. J. L. Yeowart	W. G. Scott & Co., Architects, Workington	do.
Three Bridges, Victoria Wharf, &c.	Belfast Harbour Commissioners	G. F. L. Giles, Engineer, Harbour Offices	do.
*Road-making, &c., Works, Montague-av., Brockley	Lewisham Board of Works	Surveyor, Town Hall, Catford, S.E.	Oct. 2
*Road-making, &c., Works, Crofton Park-rd., Brockley	do.	do.	do.
Steel Girders, &c.	G. W. Railway Company	G. K. Mills, Paddington Station, W.	do.
Station Buildings, Blaenavon	do.	do.	do.
Warehouse, Bridge-street, Bradford	L. and Y. Railway Company	Engineer, Hunt's Bank, Manchester	do.
Additions to Schools, near Needham Market	Battisford School Board	H. G. Bishop, Architect, Cheapside, Stowmarket	Oct. 3
Additions to School, Porth	Ystradyfodwg School Board	J. Rees, Architect, Hillside Cottage, Pentre, Glam.	do.
*New Infirmary, Acton-lane	Willesden Guardians	A. Saxon Snell, 22, Southampton-buildings, W.C.	do.
*Alterations to Parish Hall & Erection of New Schools	Vicar, St. Peter's, St. Albans, &c.	F. W. Kinneir Tarte, 12, St. Peter-street, St. Albans	Oct. 4
*Roadmaking and Sewers, &c., Enfield	Chaseside Building Estate Owners	Walton & Lee, 10, Mount-street, Grosvenor-sq., W.	do.
*Laying Stoneware Pipe Sewers, &c., Rottingdean	Newhaven R.D.C.	T. W. Franks, Engineer, Severig Buildings, Lewes	do.
Five Shops, Victoria-square, Bradford	.....	T. C. Hope & Sons, Architects, 23, Bank-street, Bradford	do.
Electric Generating Station	Limerick Town Council	J. J. Peacocke, Engineer, Town Hall	do.
*Wrought Iron Hurdles	London County Council	Park's Department, 11, Regent-street, S.W.	Oct. 5
Institute and Hall, Nantymoel, Wales	.....	J. Rees, Architect, Pentre, Glam.	do.
*Additions, &c., to Municipal Technical School	Gravesend Town Council	E. J. Bennett, Architect, 13, Gray's Inn-square, W.C.	Oct. 8
Wall at Workhouse	Newhaven Guardians	W. Gates, 86, High-street, Lewes	do.
New County Court, Middlesbrough	Commissioners of H.M. Works, &c.	H. Gritten & Son, 8, Prince's-street, S.W.	do.
*Strengthening Pier Head and Erection of Pavilion	Dover Pier Company, Limited	Engineer's Offices, 11, Dartmouth-street, Westminster	Oct. 9
Sewers, &c.	Lynington Town Council	I. Pym-Jones, Engineer, 14, High-street, Lynington	do.
Town Hall and Market Hall	Pwllheli (Wales) Town Council	E. R. Davies, 6, Church-place, Pwllheli	do.
*Unclimable Iron Fencing, Shooter's Hill	Woolwich Union	J. C. Cook, Eleanor-road, Woolwich	Oct. 10
*Buildings for Electricity Supply Works	Horsham U.D.C.	Gordon & Gunton, Architects, Finsbury House, E.C.	Oct. 11
Electricity Station	Middleton (Lancs.) Corporation	Stones & Stones, Architects, 10, Richmond-terrace, Blackburn	do.
Six Houses, Lockhurst-lane, Coventry	.....	G. & I. Steane, Architects, Coventry	No date
Additions to Alexandra Hotel, Harrogate	.....	A. A. Gibson, Architect, Harrogate	do.
Additions to Wesleyan Chapel, Kettleshulme	.....	Garlick & Flint, Architects, 5, Terrace-road, Buxton	do.
Flints, &c.	Leatherhead U.D.C.	J. R. Harding, Civil Engineer, High-street, Leatherhead	do.
Making New Streets, North-road, Bursiem	Mr. W. Heath	W. H. Whalley, Architect, Queen-street, Bursiem	do.
Two Houses, Elliotstown, Tredegar	.....	T. Lewis, The Emporium, Sirhowy, Tredegar	do.
Pupil Teachers' Centre, Wheatley-street	Coventry School Board	G. & I. Steane, Architects, Coventry	do.
Bakery, Stables, &c., Ulverston, Lancs.	Swarthmoor, &c., Co-op. Soc., Ltd.	J. Casson, Architect, Brogden-street, Ulverston	do.
National Schools, Winslow	Managers	Beazley & Burrows, Architects, 17, Victoria-street, S.W.	do.

PUBLIC APPOINTMENTS

Nature of Appointment.	By whom Advertised.	Salary.	Application to be in
*Working Superintendent of Inmate Labour	Lambeth Guardians	2*l.* 5*s.* per week	Sept. 29
*Manual Training Instructors & Assistant Instructors	School Board for London	Instructors (minimum) 100*l.*; Assistant Instructors (min.) 80*l.*	do.
*Assistant Surveyor of Roads	Gold Coast Colony (P. W. Dept.)	300*l.*	No date
*Assistant Superintendent of Buildings	British Central Africa (P.W. Dept.)	200*l.*	do.

Those marked with an asterisk (*) are advertised in this Number. Competitions, p. iv. Contracts, pp. iv, vi, viii, x, & xx. Public Appointments, p. xvii, & xx.

WEDNESDAY, SEPTEMBER 26.

Sanitary Institute (*Lectures for Sanitary Officers*).—Mr. J. Castell-Evans, F.I.C., on "Meteorology." 8 p.m.

Builders' Foremen and Clerks of Works Institution.—Quarterly meeting of the Directors. 8 p.m.

FRIDAY, SEPTEMBER 28.

Sanitary Institute (*Lectures for Sanitary Officers*).—Dr. J. Priestley, B.A., &c., on Sanitary Law: Introductory remarks, Public Health Acts—English, Scotch, Irish; other Statutes relating to Public Health; By-laws (models, &c.), Regulations, Orders, Memoranda, &c. 8 p.m.

SOME RECENT SALES OF PROPERTY:

ESTATE EXCHANGE REPORT.

September 3.—By STEPHENSON & ALEXANDER (at Llantwit Major).

Llantwit Major, Glamorgan.—Downcross Farm, 108 a. 0 r. 32 p., C (in lots) £5,585

September 6.—By STEPHENSON & ALEXANDER (at Minehead).

Minehead, Somerset.—Martlet-rd., &c., 25 freehold building sites (in lots)..... 327

September 7.—By G. B. HILLIARD & SON (at Chelmsford).

Little Baddow, Essex.—The Rodney p.h., f..... 800

September 11.—By E. SIMPSON.

Lewisham.—96 and 98, Hither Green-lane, f., r. 52*l.* 650

By T. WALKER & SON (at York).

Cornbrough, Yorks.—Freehold farmhouse and 136 a. 2 r. 20 p. 3,830

September 12.—By HEAPS, SON, & REEVE.

Maidenhead, Berks.—Queen-st., The Pilot Works, f. 2,250

By E. W. RICHARDSON & SON.

Finsbury Park.—12, Blackstock-rd., u.t. 62 yrs., g.r. 6*l.* 6*s.*, r. 50*l.* 590

By DOUGLAS YOUNG & CO.

Pimlico.—One-sixteenth share of 15, 16, 17, and 17a, Allington-st.; 1, Brewer-st.; and 1 to 5, Allington-pl., u.t. 21½ yrs., g.r. 62*l.* 235

Brixton.—4, Medwin-st., u.t. 74½ yrs., g.r. 6*l.* 10*s.* 290

September 13.—By C. C. & T. MOORE.

St. George's East.—148, St. George-st., area 2,750 ft., c., e.r. 85*l.* 1,100

Bow.—27, Alfred-st., u.t. 46 yrs., g.r. 12*l.* 10*s.*, r. 34*l.* 250

Spitalfields.—13, Fournier-st., and 1, Wilkes-st., f. 1,630

Bromley-by-Bow.—234, St. Leonard's-rd., u.t. 65 yrs., g.r. 5*l.* 235

By NOTT, CARTWRIGHT, & ETCHES.

Tooting.—13, Manor-villas, u.t. 90 yrs., g.r. 6*l.*, e.r. 34*l.* 310

Balham.—71, Elmfield-rd., u.t. 89 yrs., g.r. 8*l.* 10*s.*, e.r. 48*l.* 495

150, Bedford-hill, u.t. 75 yrs., g.r. 10*l.*, e.r. 70*l.* 730

September 14.—By MONTAGUE HIBBARD & CO.

Holloway.—20, 22, and 28, Monnery-rd., u.t. 66½ yrs., g.r. 22*l.* 12*s.*, r. 132*l.* 1,455

Contractions used in these lists.—F.g.r. for freehold ground-rent; l.g.r. for leasehold ground-rent; i.g.r. for improved ground-rent; g.r. for ground-rent; r. for rent; f. for freehold; c. for copyhold; l. for leasehold; e.r. for estimated rental; u.t. for unexpired term; p.a. for per annum; yrs. for years; st. for street; rd. for road; sq. for square; pl. for place; ter. for terrace; cres. for crescent; yd. for yard.

PRICES CURRENT OF MATERIALS.

*** Our aim in this list is to give, as far as possible, the *average* prices of materials, not necessarily the lowest. Quality and quantity obviously affect prices—a fact which should be remembered by those who make use of this information.

BRICKS, &c.

	£ s. d.		
Hard Stocks	1 15 0	per 1,000	alongside, in river.
Rough Stocks and Grizzles	1 11 0	,,	,, ,,
Smooth Bright Facing Stocks..	2 18 0	,,	,, ,,
Shippers	2 2 0	,,	,, ,,
Flettons.....	1 9 6	,,	,, ,,
Red Wire Cuts ..	1 15 0	,,	at railway depôt.
Best Fareham Red	3 11 6	,,	,, ,,
Best Blue Pressed Staffordshire ..	4 7 0	,,	,, ,,
Do., Bullnose ...	4 12 0	,,	,, ,,
Best Stourbridge Fire Bricks	4 4 6	,,	,, ,,
Best White and Ivory Glazed Stretchers.....	13 0 0	,,	,, ,,
Headers	12 0 0	,,	,, ,,
Quoins, Bullnose, and Flats	17 0 0	,,	,, ,,
Double Stretchers	19 0 0	,,	,, ,,
Double Headers..	16 0 0	,,	,, ,,
One Side and two Ends	19 0 0	,,	,, ,,
Two Sides and one End	20 0 0	,,	,, ,,
Splays, Chamfered, Squints	20 0 0	,,	,, ,,
Best Dipped Salt Glazed Stretchers and Headers ..	12 0 0	,,	,, ,,
Quoins, Bullnose, and Flats	14 0 0	,,	,, ,,
Double Stretchers	15 0 0	,,	,, ,,
Double Headers..	14 0 0	,,	,, ,,
One Side and two Ends	15 0 0	,,	,, ,,
Two Sides and one End	13 0 0	,,	,, ,,
Splays, Chamfered, Squints	14 0 0	,,	,, ,,

PRICES CURRENT (*Continued*).

Seconds Quality White and Dipped	£ s. d.	
Salt Glazed	2 0 0	per 1,000 less than best.

	s. d.		
Thames and Pit Sand	8 0	per yard, delivered.	
Thames Ballast	6 9	,,	,,
Best Portland Cement	37	per ton	,,
Best Ground Blue Lias Lime..	24 0	,,	,,

NOTE.—The cement and lime is exclusive of the ordinary charge for sacks.

Grey Stone Lime ..... 12s. 6d. per yard, delivered.
Stourbridge Fire-clay in sacks, 32s. 6d. per ton at rly. dpt.

STONE.

	s. d.	
Ancaster in blocks	9 0	per ft. cube, deld. rly. depôt
Bath ,, ...	1 7	,, ,,
Beer ,, ...	1 6½	,, ,,
Grinshill ,, ...	1 10	,, ,,
Brown Portland in blocks	2 2	,, ,,
Darley Dale ,,	2 1½	,, ,,
Red Corsehill ,,	2 5	,, ,,
Red Mansfield ,,	2 4½	,, ,,
Hard York ,,	2 10	,, ,,
Hard York 6 in. sawn both sides landings, to sizes (under 40 ft. sup.)	2 7	per ft. super. at rly. depôt.
,, ,, 6 in. Rubbed Ditto..	2 10½	,, ,,
,, ,, 3 in. sawn both sides slabs (random sizes)	1 3	,, ,,
,, ,, 3 in. self-faced Ditto	0 9	,, ,,

SLATES.

in. in.	£ s. d.	
20×10 best blue Bangor..	21 5 0	per 1000 of 1200 at ry. dep.
,, best seconds ..	10 15 0	,, ,,
16× 8 best ,,	6 2 6	,, ,,
20×10 best blue Portmadoc ..	20 18 0	,, ,,
16× 8 best blue Portmadoc	6 0 0	per 1000 of 1200 at ry. dep.
20×10 best Eureka unfading green.....	11 2 6	,, ,,
16× 8 ,, ,,	6 15 0	,, ,,
20×10 Permanent green and Sedan green	10 0 0	,, ,,
16× 8 ,, ,,	5 12 6	,, ,,

TILES.

	s. d.	
Best plain red roofing tiles..	41 6	per 1,000 at rly. depôt.
Hip and valley tiles....	3 7	per doz. ,, ,,
Best Broseley tiles	48 6	per 1,000 ,, ,,
Hip and valley tiles....	4 0	per doz. ,, ,,
Best Ruabon Red, brown or brindled Do. (Edwards)	57 6	per 1,000 ,, ,,
Do. ornamental Do.	60 0	,, ,, ,,
Hip tiles.....	4 0	per doz. ,, ,,
Valley tiles.....	3 9	,, ,, ,,
Best Red or Mottled Staffordshire Do. (Peakes) .	30 9	per 1,000 ,, ,,
Hip tiles	4 1	per doz. ,, ,,
Valley tiles.....	3 8	,, ,, ,,

WOOD.

BUILDING WOOD.—YELLOW.

	At per standard. £ s. d.	£ s. d.	
Deals: best 3 in. by 11 in. and 4 in. by 9 in. and 11 in.	16 10 0	18 0 0	
Deals: best 3 by 9	14 10 0	15 10 0	
Battens: best 2½ in. by 7 in. and 8 in. and 3 in. by 7 in. and 8 in.....	12 10 0	13 10 0	
Battens: best 2½ by 6 and 3 by 6 ..	0 10 0	less than 7 in. and 8 in.	
Deals: seconds	1 0 0	less than best	
Battens: seconds.....	0 10 0	,, ,, ,,	

	At per load of 50 ft.		
Fir timber: Best middling Danzig or Memel (average specification)	4 10 0	5 0 0	
Seconds	4 5 0	4 10 0	
Small timber (8 in. to 10 in.)	3 12 6	3 15 0	
Swedish balks.....	2 15 0	3 0 0	
Pitch pine timber (35 ft. average)..	4 0 0	4 10 0	

JOINERS' WOOD.

	At per standard.		
White Sea: First yellow deals, 3 in. by 11 in.....	27 10 0	28 10 0	
3 in. by 9 in.	24 0 0	25 0 0	
Battens, 2½ in. and 3 in. by 7 in.	20 0 0	21 0 0	
Second yellow deals, 3 in. by 11 in.	22 10 0	24 0 0	
,, ,, 3 in. by 9 in.	20 0 0	21 0 0	
Battens, 2½ in. and 3 in. by 7 in.	16 10 0	18 0 0	
Third yellow deals, 3 in. by 11 in. and 9 in.	16 10 0	18 0 0	
Battens, 2½ in. and 3 in. by 7 in.	13 10 0	14 10 0	
Petersburg: first yellow deals, 3 in. by 11 in.	25 0 0	26 0 0	
Do. 3 in. by 9 in.	22 0 0	23 0 0	
Battens.....	16 10 0	17 10 0	
Second yellow deals, 3 in. by 11 in.....	18 10 0	20 0 0	
Do. 3 in. by 9 in.	17 0 0	18 0 0	
Battens.....	14 0 0	14 10 0	
Third yellow deals, 3 in. by 11 in.....	15 0 0	16 10 0	
Do. 3 in. by 9 in.	14 0 0	14 10 0	
Battens.....	12 10 0	13 10 0	
White Sea and Petersburg:—			
First white deals, 3 in. by 11 in..	15 10 0	16 10 0	
,, ,, ,, 3 in. by 9 in. ..	14 0 0	15 0 0	
Battens.....	12 10 0	13 10 0	
Second white deals 3 in. by 11 in.	14 0 0	15 0 0	
,, ,, ,, 3 in. by 9 in.	13 0 0	14 0 0	
,, battens	11 0 0	12 0 0	
Pitch pine: deals.....	16 0 0	18 0 0	
Under 2 in. thick extra	0 10 0	1 0 0	
Yellow Pine—			
First, regular sizes	30 0 0	33 0 0	
Broads (12 in. and up)	2 0 0	more.	
Oddments	22 0 0	24 0 0	
Seconds, regular sizes	24 10 0	26 10 0	
Oddments	20 0 0	22 0 0	
Kauri Pine—			
Planks, per ft. cube	0 3 6	0 4 6	

PRICES CURRENT (*Continued*).

	At per standard. £ s. d.	£ s. d.	
Danzig and Stettin Oak Logs—			
Large, per ft. cube	0 2 6	0 2 8	
Small ,, ,, ...	0 2 4	0 2 7	
Wainscot Oak Logs, per ft. cube ..	0 5 0	0 5 6	
Dry Wainscot Oak, per ft. sup. as inch	0 0 8	0 0 9	
¾ in. do. do.	0 0 7	- - -	
Dry Mahogany—			
Honduras, Tabasco, per ft. sup. as inch	0 0 9	0 0 11	
Selected, Figury, per ft. sup. as inch	0 1 6	0 2 0	
Dry Walnut, American, per ft. sup. as inch.....	0 0 10	0 1 0	
Teak, per load	16 0 0	20 0 0	
American Whitewood Planks—			
Per ft. cube.....	0 2 3	0 3 0	

JOISTS, GIRDERS, &c.

	In London, or delivered to Railway Vans, per ton. £ s. d.	£ s. d.	
Rolled Steel Joists, ordinary sections	9 7 6	- - -	
Compound Girders ,, ,,	13 10 0	- - -	
Angles, Tees and Channels, ordinary sections	12 10 0	14 10 0	
Flitch Plates	12 0 0	- - -	

METALS.

	Per ton, in London. £ s. d.	£ s. d.	
IRON.—			
Common Bars.....	10 0 0	10 12 0	
Staffordshire Crown Bars, good merchant quality	11 5 0	11 15 0	
Staffordshire "Marked Bars" ..	13 5 0	- - -	
Hoop Iron, basis price.....	11 5 0	11 15 0	
,, ,, galvanised	17 0 0*	- - -	
(* And upwards, according to size and gauge.)			
Sheet Iron, Black.—			
Ordinary sizes to 20 g.	11 10 0	- - -	
,, ,, to 24 g.	12 15 0	- - -	
,, ,, to 26 g.	13 15 0	- - -	
Sheet Iron, Galvanised, flat, ordinary quality.—			
Ordinary sizes, 6 ft. by 2 ft. to 3 ft. to 20 g.....	14 15 0	- - -	
,, ,, 22 g. and 24 g.	15 5 0	- - -	
,, ,, 26 g.....	16 15 0	- - -	
Sheet Iron, galvanised, flat, best quality.—			
Ordinary sizes to 20 g.	18 10 0	- - -	
,, ,, 22 g. and 24 g.	19 0 0	- - -	
,, ,, 26 g.	20 10 0	- - -	
Galvanised Corrugated Sheets.—			
Ordinary sizes, 6 ft. to 8 ft. 20 g.	14 0 0	14 15 0	
,, ,, 20 g. and 24 g.	14 15 0	15 10 0	
Cut nails, 3 in. to 6 in.....	11 10 0	- - -	
(Under 3 in. usual trade extras.)			
LEAD—Sheet, English, 3 lbs. & up.	20 7 6	- - -	
Pipe in coils	20 17 6	- - -	
ZINC—Sheet—			
Vieille Montagne ..... ton	28 0 0	- - -	
Silesian.....	27 10 0	- - -	
COPPER—			
Strong Sheet..... per lb.	0 1 1	- - -	
Thin ..... ,,	0 1 3	- - -	
Copper nails ..... ,,	0 1 3	- - -	
BRASS—			
Strong Sheet..... ,,	0 0 11	- - -	
Thin ..... ,,	0 1 1	- - -	
TIN—English Ingots ..... ,,	0 1 7	- - -	
SOLDER—Plumbers' ..... ,,	0 0 8	- - -	
Tinmen's ..... ,,	0 0 10	- - -	
Blowpipe ..... ,,	0 1 0	- - -	

ENGLISH SHEET GLASS IN CRATES.

15 oz. thirds	2½d. per ft. delivered..
,, fourths	2¾d. ,, ,,
21 oz. thirds	3½d. ,, ,,
,, ,, fourths.....	3d. ,, ,,
26 oz. thirds	4½d. ,, ,,
,, ,, fourths	4d. ,, ,,
32 oz. thirds	5½d. ,, ,,
,, ,, fourths	5d. ,, ,,
Fluted sheet, 15 oz.	3½d. ,, ,,
,, ,, 21 ,, ...	4½d. ,, ,,
½ Hartley's Rolled Plate.....	3d. ,, ,,
⅜ ,, ,, ,, -----	3½d. ,, ,,
½ ,, ,, ,, -----	4d. ,, ,,

OILS, &c.

	£ s. d.	
Raw Linseed Oil in pipes.....	per gallon	0 3 1
,, ,, ,, in barrels	,,	0 3 2
,, ,, ,, in drums	,,	0 3 4
Boiled ,, ,, in pipes.....	,,	0 3 4
,, ,, ,, in barrels	,,	0 3 5
,, ,, ,, in drums	,,	0 3 7
Turpentine, in barrels	,,	0 2 5
,, in drums.....	,,	0 2 7
Genuine Ground English White Lead ...per ton		27 10 0
Red Lead, Dry.....	,,	25 0 0
Best Linseed Oil Putty.....	per cwt.	0 9 6
Stockholm Tar	per barrel	1 7 0

VARNISHES, &c.

	per gallon. £ s. d.
Fine Elastic Copal Varnish or outside work ..	0 16 6
Best Elastic Copal Varnish for outside work ..	1 0 0
Best Elastic Carriage Varnish for outside work	0 16 6
Best Hard Oak Varnish for inside work	0 10 6
Best Extra Hard Church Oak Varnish for inside work	0 10 6
Fine Hard Copal Varnish for inside work	0 16 0
Best Hard Copal Varnish for inside work	1 0 0
Best Hard Carriage Varnish for inside work....	0 16 0
Extra Pale Paper Varnish	0 12 0
Best Japan Gold Size	0 10 0
Best Black Japan	0 16 0
Oak and Mahogany Stain	0 9 0
Brunswick Black	0 9 0
Berlin Black	0 15 0
Knotting	0 10 0
Best French and Brush Polish	0 10 0

TO CORRESPONDENTS.

J. D.—(Amounts should have been stated.)
F. S. W.—H. W. D. (Next week).

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TENDERS.

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*** Denotes *accepted*. † Denotes *provisionally accepted*.**

AYLESBURY.—For the execution of paving works, Market-square, for the Urban District Council. Mr. J. H. Bradford, surveyor, Corn Exchange, Aylesbury:—

Tree & Son	£445 3 4	Ward & Cannon	£347 11 8
Burnham	384 0 0	Wadey, Stoke Newington†	302 6 8
Bristow Bros.	363 10 0		

[Recommended for acceptance.]

BASFORD (Notts.).—For additions to Boardroom at Union workhouse, Old Basford, for the Basford Board of Guardians. Mr. W. V. Betts, architect, Radford-road, Old Basford. Quantities by the architect:—
Messrs. G. Hopewell & Son, Old Basford, Nottingham*.....£420

CARDIFF.—For the erection of town hall and law courts. Messrs. Lanchester, Stewart, & Rickards, architects, 1, Vernon-place, Bloomsbury-square, W.C. Quantities by Messrs. Young & Brown, 7, Southampton-street, W.C.:—

	Law Courts. £ s. d.	Town Hall. £ s. d.	Both Buildings. £ s. d.
Shillitoe & Son	142,386 0 0	191,854 0 0	333,000 0 0
Willcocks & Co.	130,038 9 3	176,449 5 1	306,487 14 4
Pattinson & Sons	120,740 0 0	160,068 0 0	280,808 0 0
H. Lovatt			269,397 0 0
C. Wall	111,345 0 0	149,629 0 0	262,974 0 0
Patman & Fotheringham	107,400 0 0	143,720 0 0	251,000 0 0
Thomas & Co.	104,475 6 2	138,965 2 10	242,000 0 0
James Allan	101,817 0 0	139,556 0 0	240,373 0 0
S. Warburton	100,700 0 0	136,720 0 0	237,420 0 0
Turner & Sons	96,583 7 9	129,705 8 9	226,288 16 6

CHISWICK.—For alterations and additions to Tower House. Mr. J. H. Eastwood, architect and surveyor, 42, Cheniston-gardens, Kensington, W.:—
T. Nicols .....£1,133 | J. Bryant £1,128

DEWSBURY.—For paving, flagging, &c., Stoney Bank-street, for the Corporation:—
H. & W. Barraclough, Brighouse* ..£396 0 6

HISTON.—For the erection of a minister's house, Histon, Cambs. Messrs. Geo. Baines and Reginald P. Baines, architects, 5, Clements Inn, Strand, W.C.:—

E. West	£1,100	Coulson & Lofts	£810
J. G. Cowell	1,075	William Warde	896
Pamphilon & Son	1,053	Page & Son, Buckden*	825
Scales & Robins	1,000		
Thoday & Co.	995		

KING'S LYNN.—For the erection of Baptist Chapel, Wisbech-road.

Bardell Bros.	£1,739 0	Renaut Bros.	£1,590 0
W. H. Brown	1,650 0	Barnes & Co.	1,495 0
R. Shanks	1,686 15	W. F. Smith, King's Lynn*	1,470 0

LITTLEHAMPTON.—For alterations and additions to Dorset House, for Mr. George H. Beecheno. Mr. Allen Foxley, architect, 11, Great James-street, W.C. Quantities by Mr. F. R. Ashby, 17, New Bridge-street, E.C.:—
Snewin Bros., Littlehampton† £1,913

SHEFFIELD.—For the erection of seventy-two miners' cottages, Tinsley Park Collieries, for the Tinsley Park Colliery Company, Limited. Mr. Percy B. Houfton, architect, Furnival Chambers, Chesterfield:—

	Per House.		Per House.
H. Laurence	£255 0 0	Aves & Houfton, Mansfield*	£205 0 0
H. Oakey	230 4 2	A. G. Bell, Nottingham*	203 0 0
J. H. Vickers, Limited	227 10 0	Chas. Levick	200 0 0
T. Barlow	214 0 10	F. Lee	198 0 0
J. W. Hutchinson, Mansfield*	205 18 9		

* Accepted for twenty-four cottages.

TAUNTON.—For the construction of a storage reservoir, &c., Luxhay, Pitminster, for the Town Council. Mr. F. W. Roberts, engineer, Taunton. Quantities by the Engineer:—

S. Saunders	£107,817 0 0†	Bond & Hitchcock	£25,115 0 0
R. Neal	72,794 0 0	J. H. Dickson	24,554 0 0
J. Fisher	37,898 12 3	W. C. Shaddock, Plymouth*	22,653 7 4†
P. Kerley	35,744 0 0		
Cooke & Co.	35,462 0 0		
W. Gibson	29,378 3 5		
E. Powell	26,550 0 0		

WHITLEY (Northumberland).—For the execution of road works, the Promenade, &c., for the Urban District Council. Mr. J. P. Spencer, C.E., Newcastle-on-Tyne:—
Johnson, Ryton-on-Tyne* (schedule of prices).

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